KMK | Keating Muething & Klekamp PLL
ATTORNEYS AT LAW

BRIAN M. BABB
DIRECT DIAL: (513) 579-6963
FACSIMILE: (513) 579-6457
E-MAIL: BBABB@KMKLAW.COM

November 29, 2006

Ms. Mary T. McAuliffe
Associate Regional Counsel
United States Environmental Protection Agency
77 West Jackson Boulevard, Region 5
Chicago, Illinois 60604-3590

Re: Ohio Fresh Eggs, LLC - PM Controls

Dear Mary:

This letter serves as a follow-up to your letter of November 9, 2006 concerning the ESCS installation schedule for Ohio Fresh Eggs' facilities and our telephone discussion of November 17, 2006 concerning that letter. In brief, Ohio Fresh Eggs is requesting the ESCS installation schedule set forth in EPA's November 9th letter to be modified to require the company to commence installation of the ESCS by January 1, 2007 and to complete the installation of the ESCS in four barns at either of the Croton, Marseilles or Mt. Victory facilities by April 1, 2007. Upon the completion of the installation of the ESCS in four barns by April 1, 2007, Ohio Fresh Eggs would proceed with installation of the ESCS in one barn per month at the Croton facilities and one barn per month at either of the Marseilles or Mt. Victory facilities. Aside from this modification, Ohio Fresh Eggs will proceed with the approved schedule set forth in EPA's November 9th letter.

As noted in my October 17, 2006 letter to you, Ohio Fresh Eggs needed 60 days to finalize its contract with BEI to provide the ESCS and for BEI to order the ESCS. The contract between Ohio Fresh Eggs and BEI was finalized on November 11, 2006. Ohio Fresh Eggs is proceeding to order the ESCS from BEI for four barns and delivery of the ESCS is estimated in 3 to 4 weeks. We believe this modified schedule is realistic for Ohio Fresh Eggs to achieve. Your confirmation of the acceptability of this schedule is requested.

In addition, you were going to obtain clarification of the need for Ohio Fresh Eggs to obtain state air permits to install for the installation of the ESCS. As we have previously discussed, state law does not require PTIs to install the emission control devices, but rather PTIs are needed to install the air emission sources, i.e., the layer barns, however, the barns were not required to have air PTIs when they were installed. Please provide clarification of EPA's conditional approval of the installation of the ESCS to control particulate emissions, which required state air permits to be obtained.

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGIONS 5
77 WEST JACKSON BOULEVARD
CHICAGO, IL 60604-3590

REPLY TO THE ATTENTION OF:

VIA ELECTRONIC AND U.S. MAIL

February 2, 2007

Mr. Brian M. Babb, Esq.
Keating, Muething & Klekamp, P.L.L.
1400 Provident Tower
One East Fourth Street
Cincinnati, OH 45202

RE: Review of Ohio Fresh Eggs, LLC's November 1, 2006 Revised Ammonia Emissions Control Design and Implementation Plan for Ohio Fresh Eggs, LLC's Croton, Marseilles, and Mt. Victory, Ohio Facilities (U.S. v. Buckeye Egg Farm, L.P., et al. - Civil Action No. 3:03 CV 7681)

Dear Brian:

This letter acknowledges the U.S. Environmental Protection Agency's (EPA's) receipt of Ohio Fresh Eggs, LLC's (OFE's) November 1, 2006 Revised Ammonia Emissions Control Design and Implementation Plan for Ohio Fresh Eggs, LLC's Croton, Marseilles, and Mt. Victory, Ohio Facilities (Ammonia Control Plan). We have reviewed OFE's Ammonia Control Plan, and approve the proposal under the conditions specified below. This approval is based on the information submitted and our understanding of your proposal as outlined below. Our approval is also dependent on OFE conducting emissions testing using the secondary test methods for ammonia over a continuous three-month period which includes both colder months and warmer months (to the degree the Midwest weather allows). Finally, OFE will need to consider slight revisions to the testing plan as a result of the multiple best management practices (BMPs) it is proposing. OFE must identify the site-specific impacts of each BMP during the three months of testing. We will not require each BMP be tested for three months, but OFE must conduct short-term testing within each of the two barns. The purpose of this requirement is to identify the ammonia reduction benefit of each BMP. We would be happy to discuss this further with you during a call prior to implementing the full three-month test.

Review and Determination:
OFE proposes to implement and test an enhanced fiber diet, as well as certain best management practices, to reduce ammonia emissions by fifty percent or more as required by the Consent Decree. OFE intends to use dry distiller grain solids (DDGS) as its enhanced fiber. DDGS is a secondary product of ethanol production from corn.

OFE also proposes various best management practices (BMPs) as a possible means to reduce ammonia emissions further. OFE's proposal includes the following BMPs:

1) Use of additional pit fans (40 fans in the test building);
2) Improved preventative and corrective measures to reduce leakage from water lines;
3) Reduction of crude protein in the feed rations;
4) Reduced chlorine in feed rations (by substituting sodium bisulfate for chlorine);
5) Compliance with the United Egg Producers guidance to reduce the number of birds within each cage in caged layer houses; and/or
6) Frequent manure turning.

We approve the proposal to use the DDGS as an enhanced fiber within the birds' diet. We understand that DDGS can act as a fiber within a diet and can be received in various concentrations from the supplier. OFE needs to clarify what type of product it intends to receive as DDGS (percent fiber, sugars, etc.) once it is identified, as this can have an impact on the overall ammonia reduction. Any final product make-up must be incorporated into some enforceable document to assure that compliance with the CD ammonia reduction requirements is maintained after testing is complete.

We approve the use of additional pit fans within the test building. OFE must realize that, as part of the overall proposed ammonia control plan, the number of fans operated and how often the fans are operated during the testing will need to become permanent requirements upon completion of the testing. If the necessary reductions are achieved, OFE will need to memorialize the number of fans and operating hours into some enforceable document to assure that compliance is maintained after testing is complete. If OFE wishes to change the number of fans or length of operation, additional testing may be necessary to assure such changes do not impact ammonia reductions in such a way as to fall below the fifty percent level of reductions.

We approve your proposal to implement improved leak preventative/corrective measures to reduce water and moisture from water lines draining into the manure pits. OFE will need to provide a copy of the "improved" preventative/corrective measures plan for review. The "improved" plan should identify what OFE intends to do as well as identify or explain how it will result in successful reductions in leaks, etc. OFE will also need to provide a copy of the current leak preventative/corrective measures plan it is implementing to allow comparison.

We approve your proposal to reduce crude protein in the feed rations for OFE birds by one percent. OFE must provide a validation that the crude protein was reduced by one percent once implemented for testing purposes. If reductions are successful and OFE chooses to implement the crude protein reduction permanently, OFE will need to maintain records which verify the crude protein is maintained at the reduced level. The maintenance of these records must be incorporated as a requirement into some enforceable document to assure they are maintained on an ongoing basis, once testing and implementation are complete.

We approve your proposal to reduce chlorine (i.e., salt) in the feed rations for OFE birds by 0.095 percent. OFE believes that this reduction in the chloride will help reduce the bird's water intake. If this occurs, it could have a possible impact on ammonia reductions by decreasing moisture within the manure (either excreted or leaking from waterline use by the birds). If reductions are successful and OFE chooses to implement the chlorine reduction permanently, OFE will need to maintain records which verify the feed chloride levels are maintained at the reduced level. The maintenance of these records must be incorporated as a requirement into some enforceable document to assure they are maintained on an ongoing basis, once testing and implementation are complete.

We approve your proposal to comply with the United Egg Producer's (UEP's) guidance to reduce the number of birds within each cage in cage layer houses. We note, however, that we do not view this activity as a direct effort by OFE to comply with the Consent Decree ammonia reduction requirements since OFE intended to implement the UEP guidance prior to settlement of this case. Our current understanding of the UEP guidance is that it actually establishes a recommendation to increase the number of square inches within a cage each bird has. In essence, a larger square inch requirement per bird would likely have the effect of reducing the number of birds per cage (or if cages are made larger, then fewer cages would fit within a set cage frame within each barn). If OFE intends to comply with this guidance by increasing the sizes of the cages, barns, and other factors where a reduction in bird numbers does not occur, then it would not be considered an acceptable part of the ammonia control plan. Although the requirements of the UEP guidance will not need to be incorporated into an enforceable document to assure OFE complies with it, the impact of the guidance on the number of birds will need to be incorporated into some enforceable document. We believe a limit on the total number of birds (per year since the guidance is implemented over several years) resulting from implementation of the guidance will be adequate to assure compliance with this aspect of the ammonia control plan. OFE should be aware that an increase in the number of birds (larger cages, larger barns, etc.) beyond the results of implementing the UEP guidance would all require review for purposes of modifications to the OFE facilities. OFE will need to identify the number of birds and track the decrease as the UEP guidance is implemented through 2008. The final number of birds after full implementation of the UEP guidance will need to be incorporated into some enforceable document to assure it is maintained.

We do not approve your proposal to implement more frequent manure turning as part of your ammonia control plan for purposes of the CD. We have multiple concerns with this proposal based on past knowledge and experience with the manure turning. First, manure turning will result in an increase in the amount of PM emitted when such turning events occur. Although PM controls have been approved (the electrostatic space charging system, ESCS) under the Federal Consent Decree and are currently being implemented across all three laying facilities (Croton, Marseilles and Mt. Victory), the resulting increase in PM from manure turning was not investigated during the ESCS testing. Second, a previous study conducted for purposes of a State action on the effectiveness of the manure turning in reducing moisture showed little, if any, effect. Third, by implementing the manure turning, OFE will actually be breaking apart the crust that typically will form over manure which helps reduce PM emissions as well as contain ammonia. By breaking the crust, OFE would, in essence, cause PM and ammonia emission spikes during each turning event, for each barn where it is implemented.

Conclusions:
We approve OFE's proposed ammonia control plan dated November 1, 2006. This approval is granted under the conditions identified above. OFE must realize the proposals made for a higher fiber diet and BMPs, (bird numbers, fan use, etc.) requires that certain records and reports be maintained. There must also be an effective means through which the requirements can be enforced to assure compliance with the fifty percent or more ammonia reduction requirements of the Consent Decree on a continuous basis, once implemented.

If you have any questions regarding this letter or the conditions outlined above, feel free to call me at (312) 886-6237. It may also be useful for us to hold a conference call to discuss this letter, your proposals, and other aspects of the current Consent Decree compliance status.

Sincerely,

Mary T. McAuliffe

Mary T. McAuliffe
Associate Regional Counsel

cc: Deborah M. Reyher
Kevin Vuilleumier
Cary Secrest
Sanda Howland

Effects of Electrostatic Space Charge System on Particulate Matter Emissions from High Rise Layer Barn

Final Report

to

Ohio Fresh Eggs, LLC

11492 Westley Chapel Rd, Croton, OH 43013

by

Albert J. Heber, Teng Teeh Lim, Ji-Qin Ni, Samuel M. Hanni, Claude A. Diehl, Chaoyuan Wang, and Lingying Zhao

Agricultural and Biological Engineering Department

Purdue University

225 S. University St.

West Lafayette, IN 47907

Phone: 765-494-1214

May 31, 2006

EFFECTS OF ELECTROSTATIC SPACE CHARGE SYSTEM ON PARTICULATE MATTER EMISSIONS FROM HIGH-RISE LAYER BARN

Albert J. Heber, Teng Teeh Lim, Ji-Qin Ni, Samuel M. Hanni, Claude A. Diehl, Chaoyuan Wang, and Lingying Zhao

Abstract

Emission rates of particulate matter (PM), including PM_{10} (particulate matter of 10 μm and smaller) and TSP (total suspended PM), were measured at two 169,000-hen capacity high-rise layer barns (Barns 1 and 2). The tests were conducted at the Mt. Victory facilities owned by Ohio Fresh Eggs to evaluate baseline and mitigated emission rates, as required by a federal consent decree. Continuous emission data was collected from September 1, 2005 to March 4, 2006. An Electrostatic Space Charge System (ESCS) was installed and tested for PM removal efficacy in the manure pit of Barn 2. Concentrations of PM_{10} and TSP were measured at representative barn exhaust fans and ambient locations (PM_{10} only). Concentrations of PM_{10} were measured continuously using tapered element oscillating microbalance monitors. TSP concentrations were evaluated gravimetrically with three replications per sampling event, collected one to three times per week per barn. Other measured variables included inside and outside temperature and relative humidity, bird activity, building static pressure, fan operational status, and barn ventilation rate. The average daily mean untreated net emission rates ranged from 1.15 to 11.9 g d^{-1} AU^{-1} for Barn B1 and averaged 5.03 g d^{-1} AU^{-1} (14.1 mg d^{-1} hen^{-1}) for Barn 1. The ESCS operation reduced PM_{10} emission by 47% based on the overall cross-barn comparison. When the ESCS was switched off on weekends (Tests 5 to 7) for within-barn comparisons, the PM_{10} emission reduction was only 12%. The PM removal efficiency of the ESCS in Tests 5 to 7 was hindered by power unit failures and performance or the ESCS, and introduction of a new flock of hens into Barn 2. Higher reductions were achieved (48% PM_{10} reduction in Test 1, and 36% PM_{10} reduction in Test 7, after the new hens had adapted to their new environment) at certain test periods. The mean TSP emission rates were 49.1, 35.1, and 43.5 g d^{-1} AU^{-1} (252, 238 and 191 mg/s) for Barn 1, untreated Barn 2, and treated Barn 2, respectively. Barn 2, with the ESCS, had 18% less overall gross TSP emissions than Barn 1. When comparing the overall treated and untreated Barn 2 emissions, the ESCS reduced the TSP emission rate by 19%.

Introduction

Ohio Fresh Eggs, LLC owns egg production facilities located in Croton, Licking County, Ohio ("Croton Facilities"), Harpster, Wyandot County, Ohio ("Marseilles Facilities"), and LaRue, Hardin County, Ohio ("Mt. Victory Facilities"). The facilities are subject to the requirements of the Consent Decree in *United States vs. Buckeye Egg Farm, L.P., et al.,* United States District Court, Northern District of Ohio, Western Division, Civil Action No. 3:03CV7681.

The Electrostatic Space Charge System (ESCS) was tested from September 1, 2005 to March 4, 2006 in Barn 2 (B2) of Ohio Fresh Egg's Mt. Victory laying facility (Site #5). The ESCS was installed and operated in B2, while Barn 1 (B1) served as the untreated barn for comparison. An on-farm instrument shelter (OFIS) was used to house instruments to measure air emissions from the two mechanically-ventilated barns.

The test was conducted at the site of the six-month Particulate Impaction System test that ended on January 31, 2005 (Lim et al., 2005). A system for applying a litter amendment called Alum (Aluminum Sulfate) was also installed in B2 to control ammonia. The ESCS was initially operated for several days without Alum, followed by an independent (with the ESCS off) test of Alum, and another independent test of the ESCS. By the end of September 2005, both Alum and ESCS were operated simultaneously. In order to establish more untreated PM emission data, the ESCS was turned off on the weekend starting November 28, 2005. The tests were conducted by Dr. Teng Teeh Lim, Purdue University, and Mr. Chaoyuan Wang, Ohio State University, with supervision and oversight by Dr. Albert Heber, Purdue University.

This was the first test of an electrostatic PM removal system ever conducted in a large layer barn. The objective of the test was to determine efficacy of ESCS in controlling emissions of particulate matter (PM) from a high-rise layer barn. Specifically, the objectives were to evaluate whether the ESCS has the potential to reduce PM_{10} and TSP concentrations and emission rates.

Methods and Procedure

Description of Laying Barn

The two caged-hen layer barns at Mt. Victory, Ohio (20449 County Rd 245, Mt Victory, OH 43340) were built in 1994, along with 12 other barns at the facility. The barns were 201 m x 20.7 m, oriented E-W, and spaced 20.7 m apart (Figure 1). Each barn housed about 169,000 hens in eight rows of 4-tier crates in the 3.3-m high upper floor. Manure was scraped off boards under the cages into the 3.2-m high first floor. Manure drying on the first floor was enhanced with eighteen, 918-mm dia. auxiliary circulation fans (Model VG36DM3F, J&D Manufacturing, Eau Claire, WI).

The two barns were the same that were used in the previous test of the Particulate Impaction Curtain. A major difference was the locations of the manure drying fans in the manure storage pit on the first floor of the barn. The 918-mm dia. auxiliary circulation fans (Model VG36DM3F, J&D Manufacturing, Eau Claire, WI) were repositioned and rearranged to generate air patterns in a 45-degree angle with the length of the barn to minimize exposure of the fans to the sprayed Alum solution. Birds were placed in Barns 1 and 2 in July, 2004 and February, 2005, respectively.

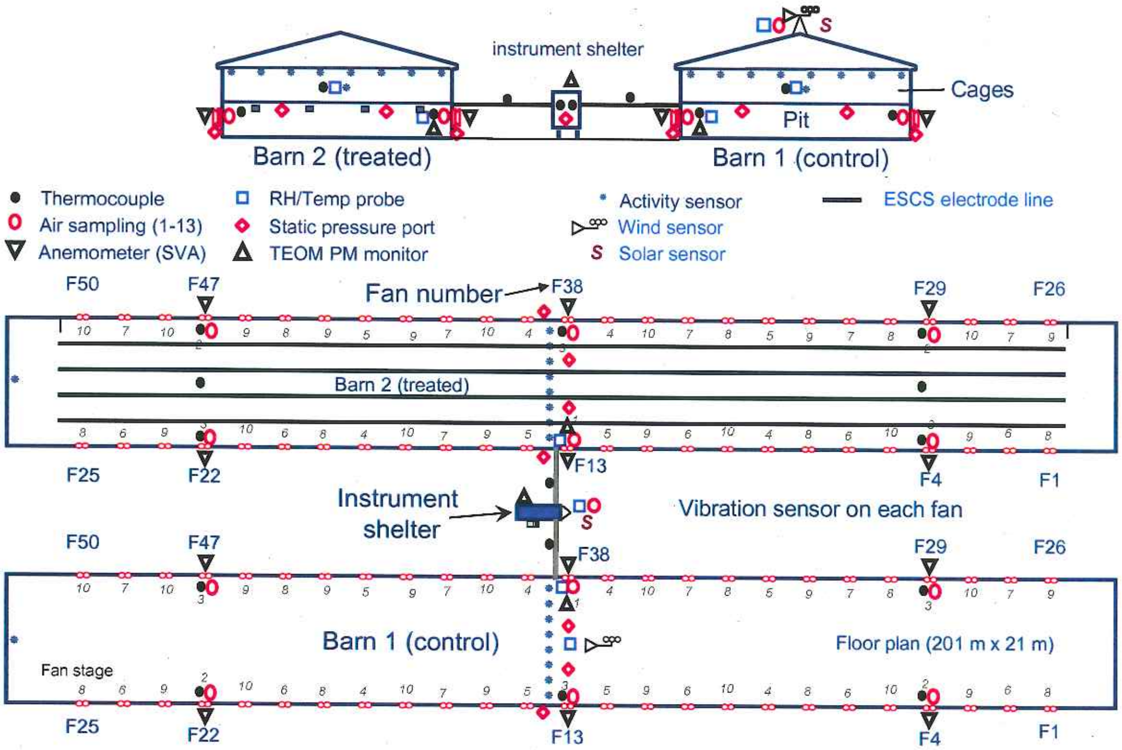

Figure 1. Layout and Cross-Section of High-Rise Layer Barns Showing Monitoring Locations.

Ventilation air was brought into the barns from the attic through temperature-adjusted baffled ceiling air inlets above the cages, and exited through continuous manure slots beneath each cage row into the pit. There were twenty-five, 1.2-m (48-in.) dia. belted exhaust fans (fans 1-25) (Advantage Fan Model AT481Z3CP, Aerotech, Lansing, MI) distributed along the east sidewall and 25 on the west sidewall (fans 26-50), Figure 1. The fans were spaced 7.3 m (24 ft.) apart and were grouped into 10 ventilation stages for this monitoring test. Each barn was originally ventilated in 26 rotating stages. The first, second and third stages consisted of 1, 2 and 3 fans each. Eggs were removed by conveyors into the egg processing plant. The cage lights were shut off for several hours each night. Egg production and water and feed consumption were also recorded automatically, while daily hen mortalities were recorded manually by the collaborating producer.

Description of Electrostatic Space Charge System

The ESCS (Baumgartner Environics Inc., Olivia, MN) utilizes electrodes to impart electrical charges to particles as they move through the charging field. The charged particles are then attracted to a ground panel, the floor, the manure, and other grounded surfaces. Power supplies with high voltages of 25K–30K VDC and about 2 mA capacity supplied cables with 24 ion discharge needles per foot. Four cables ran along the entire length of Barn 2 and were spaced uniformly across the width of the barn (Figure 1). Operation of each ESCS electrode line was monitored by continuously measuring and recording the voltages and current draws of from each of the four power supply units.

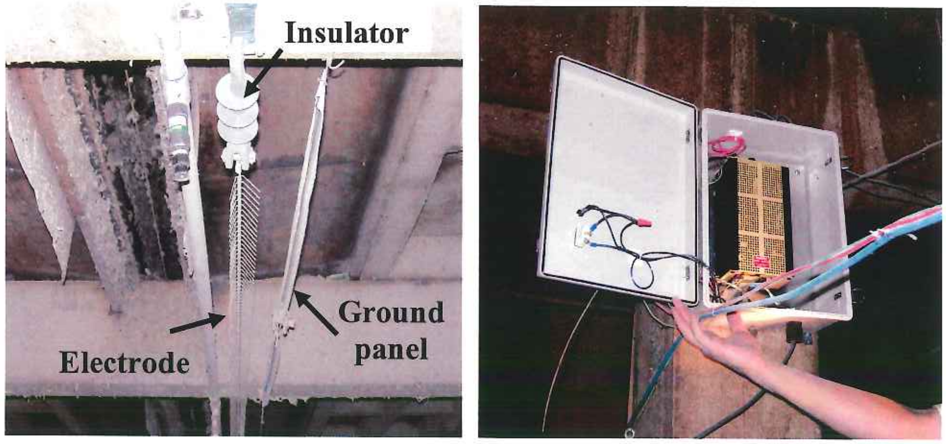

Figure 2. ESCS electrodes and ground panel installed at the ceiling of the manure storage pit (left), and the modular high-voltage supply unit (right).

Experimental Design

Several tests were conducted during the six-month evaluation of the ESCS. In Test 1, the ESCS was tested independently from September 1-10, 2005. The tests were conducted in conjunction with the applications of Aluminum Sulfate (Alum) and Aluminum Chloride, September 11, 2005 to March 31, 2006. Both the ESCS and Alum tests were conducted in B2, while B1 served as an untreated (control) barn. In Test 2, the Alum was tested independently from September 11-20, 2005. The ESCS was tested independently again from September 21-29, 2005, which was Test 3. The Alum-spraying system and ESCS again operated simultaneously between September 30 and November 21, 2005 (Test 4). It is assumed that the Alum spraying did not affect the PM concentration, since it was sprayed only three seconds per hour. With this assumption, the results of Test 2 can be compared with Tests 1, 3 and 4 to assess the PM reduction potential of ESCS.

Table 1. Tests conducted during study.

Test	Date	Description
1	9/1-9/10	ESCS only
2	9/11-9/20	Alum only
3	9/21-9/29	ESCS only
4	9/30-11/21	Alum+ESCS
5*	11/22-12/12*	Alum + partial ESCS operation
6	12/23-1/19	Alum + partial ESCS†, new hens in B2
7	1/20-3/4	Alum+ESCS

* ESCS was switched off on weekends, starting November 28, 2005.

† ESCS was repaired; all four lines working again on January 15, 2006.

In Test 3, the ESCS cable and electrodes were moved about 15 cm away from the Alum-spraying system to avoid damage due to high voltages. Additional adjustment was made on September 26, 2005 to increase the ESCS voltage. There were also two ESCS failures

(75% operation, as 1 of 4 lines were down) for over a month. A power supply unit (line 2) of the ESCS was found malfunctioned from November 22 to December 12, 2005, while unit 3 also failed from December 6, 2005 to January 3, 2006. A short malfunctioning period (lasted from January 12-15, 2006) was also observed for the ESCS line 4. Since there were several power supply unit failures during this test period, part of the data was grouped into one individual test (Test 5) to better study the ESCS performance.

Starting on November 28, 2005, the ESCS lines were switched off at noon every Friday, and left so until noon, Monday, to establish the B2 untreated baseline data. Barn 2 was emptied of old hens on December 12, 2005, and was restocked with new birds on December 18, 2005. Only full barn data was included in this data set to avoid biasness. Since it was expected that the new flock of hens would create more PM emission while they were adapting to the new environment, the first five weeks of data was separated as Test 6. In Test 7, after January 20, 2006, the PM concentrations in B2 seemed to have stabilized.

Instrument Shelter and Raceway

An air-conditioned trailer (7.3 m x 2.3 m x 2.1 m) was located between the two barns to protect instruments and provide storage and on-site laboratory and office space for researchers. The on-farm instrument shelter (OFIS) was connected to the two barns using suspended and heated 10-cm ID PVC pipe raceways, which protected signal cables and vacuum tubes. The TEOM vacuum tubes and air sampling tubes were bundled together with heating tape and insulated. The temperatures (three points per raceway) were monitored closely for heating control to prevent condensation in the tubes.

Particulate Matter Concentration

Particulate matter (PM_{10}) concentrations were measured with a continuous ambient PM_{10} monitors (Tapered Element Oscillating Microbalance, TEOM Model 1400a, Rupprecht & Patashnick, Albany, NY) immediately upstream of Fan 38 in B1 and Fan 13 in B2. The TEOM pumps and controllers were stationed in the OFIS, while the sampling inlets and sensor units were positioned in the two barns. Ambient PM_{10} concentration was measured by placing a third TEOM monitor with inlet positioned on top of the OFIS (Figure 1). The sample stream temperature was maintained at 50°C following the original settings. The reported PM concentrations were adjusted to one atmosphere and 20°C.

Concentrations of total suspended particulate (TSP) were measured gravimetrically with critical venturi to control sampling flow rate (Jerez et al., 2005). A three-point sampler that draws 20 L/min of sampling air through each of three 37-mm glass fiber filters (loaded in 3-piece open-face filter holders) was located at the inlets of the exhaust fans next to the TEOM inlets. TSP sampling was conducted one to three times per week, with sampling periods of one to three days. The isokinetic sampling nozzles were located at three different heights within the fan inlet (less than 0.5 m from the fan impellers). The filter holders were fitted with isokinetic sampling nozzles that pointed into the exhaust air leaving the barns. The locations of TSP sampling heads were carefully selected to match the 2 m/s airflow speed of isokinetic sampling. The air velocities around each sampling nozzle (4-point per nozzle) were measured by using a portable vane thermoanemometer (Model 451126, Extech, Bohemia, NY).

Pressure Measurement

Differential pressures across each building sidewall as fan operating pressures were monitored continuously using differential pressure transmitters (Model 2671-100-LB11-9KFN, Setra, Boxborough, MA). Measurement range of the transmitter was ±100 Pa, with an accuracy of ±1%. The purposes of differential pressure measurements were to monitor operation of the ventilation system, and to aid in the calculation of fan airflow using fan performance curves. The pressure sensor was shunted for calibration checking and compared with an inclined manometer at various span pressures. Atmospheric pressures were monitored with barometric pressure transducers in the TEOMs

Ventilation and Environmental Variables

The operating status (on/off) of each fan stage was monitored via auxiliary contacts of fan motor control relays, backed up with either an open impeller anemometer or a vibration sensor (Ni et al., 2005) installed at each individual fan. Fan airflow capacities were measured on October 5 and 6, with a calibrated portable fan tester that consisted of multiple traversing impeller anemometers (Gates et al., 2004). During these tests, the building static pressure was recorded and the airflow was compared with the ventilation rates estimated from independent tests conducted for the fan model and published by the manufacturer. The actual fan airflow was estimated from static pressure using a fourth-order polynomial equation that was developed for each ventilation fan, based on the field test data.

The temperature and humidity of exhaust air, along with barometric pressure, were needed for volume correction to standard conditions. Copper-constantan thermocouples (Type T) were used to sense temperatures throughout the barns and in the OFIS at various locations: 1) exhaust sampling points, 2) heated raceways, and 3) trailer and instrumentation. The sensors were calibrated prior to and following the test using a constant-temperature bath.

A relative humidity (RH) and temperature (T) probe (Model HMW61, Vaisala, Woburn, MA) was collocated with each TEOM (Figure 1). Another RH/T probe (Vaisala Model Humitter 50Y) was located in an emptied cage at the center of each barn. A solar-radiation-shielded RH/T probe (Vaisala Model HMD60YO), a cup anemometer, and wind direction vane were attached to the top of the barn.

Hen activity was monitored using passive infrared motion detectors (Model SRN-2000N, ADI Inc., Bridgeview, IL) that generated voltages proportional to movement. The detectors were mounted on the ceiling above each row of cages in both barns and tilted slightly downward to face the cages.

Manure Sampling and Analysis

Manure from the layer barns was sampled monthly to determine moisture content and pH values, which are important factors affecting PM and NH_3 emissions. Thirty-six (36) surface samples were collected from randomly selected locations in each barn. After collection, the samples were put on ice and delivered to the Purdue Manure Analysis Laboratory for analysis of moisture content and pH.

Data Acquisition and Processing

A custom PC-based data acquisition and control (DAC) program was developed using LabVIEW for Windows (National Instruments Co., Austin, TX). The program communicated with DAC hardware, which included several external DAC modules and an internal card (FieldPoint and PCI 6601 DIO, National Instruments Co., Austin, TX, respectively). A separate internal DAQ card coupled with an external expansion board (PCIM-DAS1602/16 and EXP32, respectively, Measurement Computing Corporation, Middleboro, MA) provided 32 more analog input channels. Four digital input modules (Measurement Computing Corporation MiniLab™ 1008 Personal Measurement Devices) acquired digital input signals from the vibration sensors. Data acquired by the DAQ system were sampled at a frequency of 1 Hz, then averaged every 15 s and 60 s, and recorded.

A custom data processing program, CAPECAB (Calculation of Aerial Pollutant Emissions from Confined Animal Buildings), was used to process the 60-s data set (Eisentraut et al., 2004a; 2004b). PM concentrations were converted to concentrations at standard temperature and pressure (STP, 1 atm and 20°C) for calculating emissions. Average daily means (ADM) were calculated using only days with over 70% valid data (complete-data days). ADM for both barns were calculated as weighted means.

Since the PM_{10} concentrations reported by TEOMs were based on 1 atm pressure and 25°C, the gross PM_{10} emission rate was calculated as:

$$E = Q_0 \cdot \frac{P_0}{P'} \cdot C_0^* \cdot \frac{273 + T^*}{273 + T_0} = 1.017065 Q_0 \cdot P_0 \cdot C_0^* \qquad (1)$$

Where:

E	Gross PM_{10} emission rate, µg/s
Q_0	Exhaust airflow rate at T_0, m³/s
P_0	Pressure of exhaust air, atm
P'	Standard pressure, 1 atm
C_0^*	PM concentration recorded by TEOM in exhaust air, µg/m³
T^*	Temperature basis of TEOM reported concentrations, 25°C
T_0	Temperature of exhaust air, °C

Results

All of the reported average daily mean (ADM) or hourly mean values consisted of over 70% valid data (complete-data days or complete-data hours) to avoid biasness due to missing data. The data completeness for PM_{10} emission, in terms of the number of days with over 70% valid data, were 92% and 76% for B1 and B2, respectively. The fewer complete-data days for B2 emission rate was partially due to the changing of hen flocks, which was about 6% (11 days) of the 185 measurement days.

The basic statistics of important variables, including barn inventory, environment variables, and ADM emission values are reported in Tables 2 and 3. The monitoring test started with 158,787 and 153,660 hens, and ended with 154,729 and 157,031 hens in B1 and B2, respectively (Figure 3). A new flock of hens was introduced into B2 in mid-December 2005; thus the beginning and ending bird numbers were not the maximum and minimum values. The flocks of W36 hens in B1 and B2 were 46 and 73 weeks old when the monitoring test started, and were 72 and 29 weeks old when the test ended. The ADM bird mass was 1.40 and 1.53 kg for B1 and B2, respectively. The ADM total live mass of B1 and B2 were 440 and 468 AU (AU=500 kg live mass), respectively. B2 started with a new flock of hens which was still growing, and was gaining weight faster when newly introduced into B2 (Figure 3).

Table 2. Summary of Daily Means at Barn 1. 9/1/2005 to 3/4/2006.

Parameter	n	Min	Mean	Max	SD
Bird inventory, n	185	154,729	156,884	158,787	1237
Mean bird mass, kg/bird	185	1.37	1.40	1.45	0.02
Total live mass, AU	185	427	440	457	6.5
Temperatures, °C					
Ambient air	175	-13.1	5.65	21.7	8.81
Cages	171	20.3	23.1	26.8	1.50
Exhaust air	171	13.8	20.4	26.4	3.01
Airflow, dsm³/s	165	29.1	78.6	257	59.8
Particulate Matter (PM_{10})					
Ambient conc., μg/dsm³	170	13.2	73.8	188	37.3
Exhaust conc., μg/dsm³	170	144	475	883	135
Net emission, mg/s	168	5.95	26	60	7.74
Net emission, kg/d	168	0.51	2.21	5.21	0.67
Net emission, g d^{-1} AU^{-1}	168	1.15	5.03	11.9	1.51
Net emission, mg d^{-1} hen^{-1}	168	3.24	14.1	33.6	4.26
Total Suspended Particulate (TSP)					
Exhaust Concentration, μg/dsm³	51	1925	3129	4160	599
Emission Rate, mg/s	52	49.3	252	715	147
Emission Rate, g d^{-1} AU^{-1}	52	9.69	49.1	138	28.2

Table 3. Summary of Daily Means at Barn 2. 9/1/2005 to 3/4/2006.

Parameter	n	Min	Mean	Max	SD
Bird inventory, n	177	148,197	153,816	158,120	3365
Mean bird mass, kg/bird	180	1.12	1.53	1.66	0.11
Total live mass, AU	177	354	468	495	26.4
Temperatures, °C					
Ambient air	175	-13.1	5.65	21.7	8.81
Cages	163	15.5	21.9	27.1	3.02
Exhaust air	155	9.79	19.6	26.3	3.90
Airflow, dsm^3/s	153	31.1	84.1	287	66.3
Particulate Matter (PM_{10})					
Exh. Conc., µg/dsm^3, Untreated	46	238	613	1534	368
Exh. Conc., µg/dsm^3, Treated	99	183	494	1474	283
Untreated Emission, mg/s	45	8.80	35.0	64.5	17.6
Untreated Emission, kg/d	45	0.76	3.0	5.6	1.52
Untreated Emission, g d^{-1} AU^{-1}	45	1.66	6.71	14.8	3.68
Untreated Emission, mg d^{-1} hen^{-1}	45	4.84	19.4	36.2	9.71
Treated Emission, mg/s	95	7.02	27.5	85.0	15.0
Treated Emission, kg/day	95	0.61	2.38	7.35	1.30
Treated Emission, g d^{-1} AU^{-1}	95	1.29	5.15	17.2	3.11
Treated Emission, mg d^{-1} hen^{-1}	95	3.86	15.4	46.5	8.20
Total Suspended Particulate (TSP)					
Untreated Concentration, µg/dsm^3	9	1243	2067	3556	708
Untreated Emission Rate, mg/s	9	59.5	238	750	240
Untreated Emission Rate, g d^{-1} AU^{-1}	9	11.1	43.5	133	42.0
Treated Concentration, µg/dsm^3	38	926	2186	3858	680
Treated Emission Rate, mg/s	38	36.1	191	548	141
Treated Emission Rate, g d^{-1} AU^{-1}	38	6.36	35.1	97.7	24.8

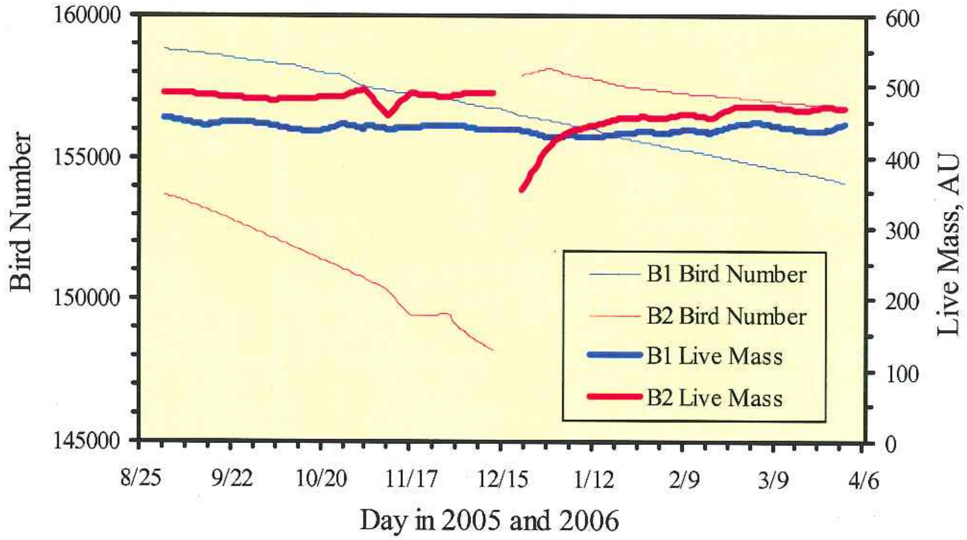

Figure 3. Bird number and total live mass.

The ADM airflow rates of B1 and B2 were 78.6 and 84.1 dsm³/s, respectively. As expected, barn ventilation rates were generally higher in warm weather (Figure 4). Daily mean airflow rate ranged from 29 to 257 dsm³/s for B1, and ranged from 31 to 287 dsm³/s for B2. The ADM ambient temperature was 5.7°C (ranged from -13.1°C to 21.7°C), and was lower than the mean annual local temperature of 10.0°C. Similar polynomial equations relating airflow rate and ambient temperature were developed for each barn, suggesting that the two barns had similar ventilation rate and temperature control (Figure 5). Close correlation between the ambient temperature and barn airflow rate was also found in a previous study (Lim et al., 2005). A paired t-test was conducted to examine the barn ventilation rates, and indicated that the two were not significantly different (P=0.002).

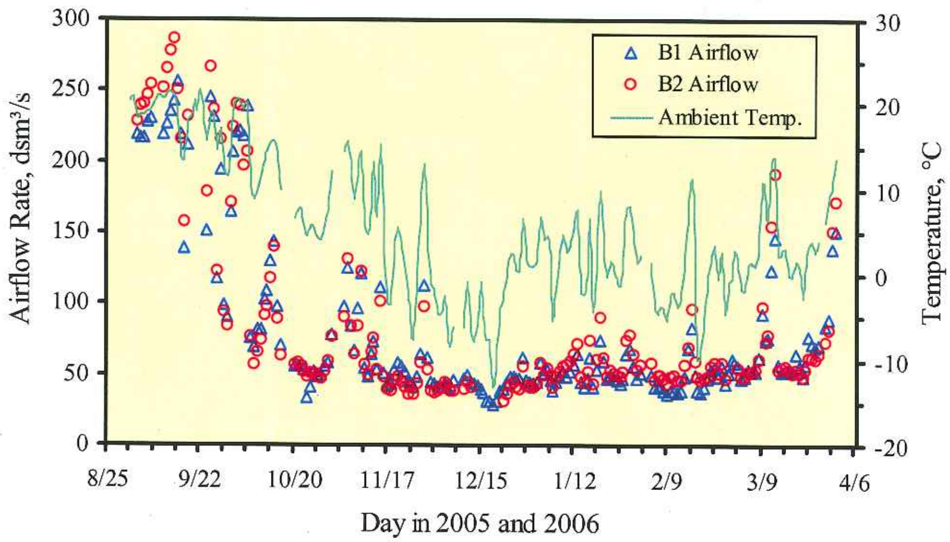

Figure 4. Barn ventilation rate and ambient temperature.

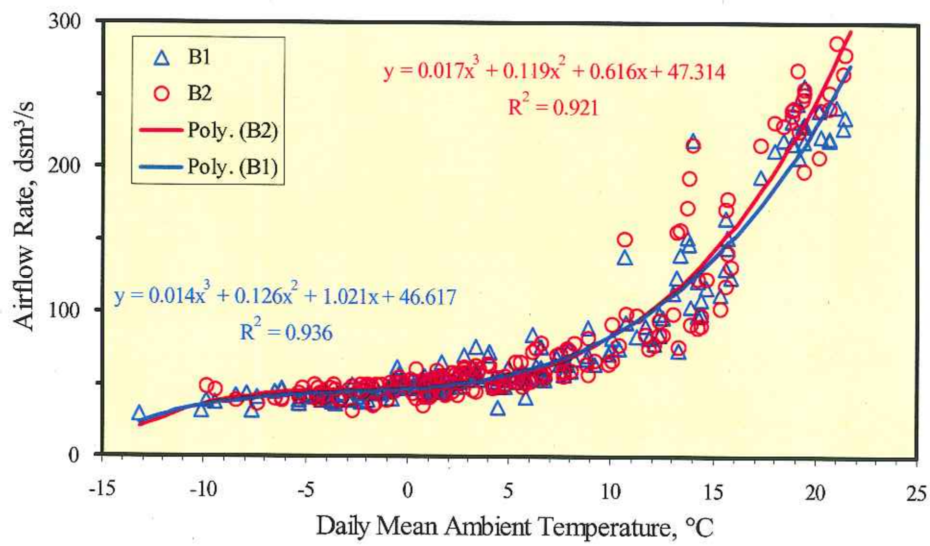

Figure 5. Influence of ambient temperature on barn ventilation rate.

The daily mean barn (cage level) and pit exhaust temperatures are presented in Figure 6. The ADM cage temperatures (centers of cages) were 23.1°C and 21.9°C for B1 and B2, respectively, and were not statistically different based on a paired t-test ($P<0.001$). However, the temperatures of B2 were maintained generally higher at the beginning of the test, and became generally lower than B1 starting in December with the new flock of hens (Figure 6). The ADM exhaust temperatures (up to six sampling locations) were 20.4°C and 19.6°C for B1 and B2, respectively. Only two thermocouples of the six installed were used to measure B2 exhaust temperatures, because the other four detected static noises from the high voltage operation of the ESCS, and were thus disconnected.

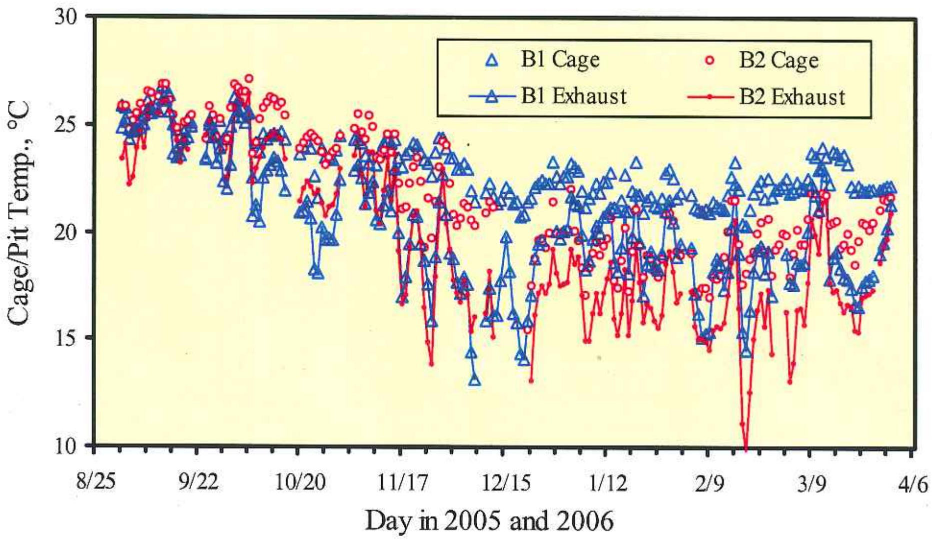

Figure 6. Daily mean cage and pit exhaust temperatures

The ADM fan differential pressures (averages of the west and east sidewall sensors) were -24.7 and -11.9 Pa for B1 and B2, respectively (Figure 7). The daily mean fan pressures ranged from -5.4 to -32.6 Pa, and -2.5 to -16.8 Pa for B1 and B2 respectively. It is not known why did the two barns had such difference in the fan differential pressure, even though they had similar barn temperatures and ventilation rates. The inconsistent B1 pressures in the months of September and October 2005 indicated pressure was not well maintained, suggested that the ventilation inlet openings were not controlled according to barn static pressure to provide optimum ventilation fan operation.

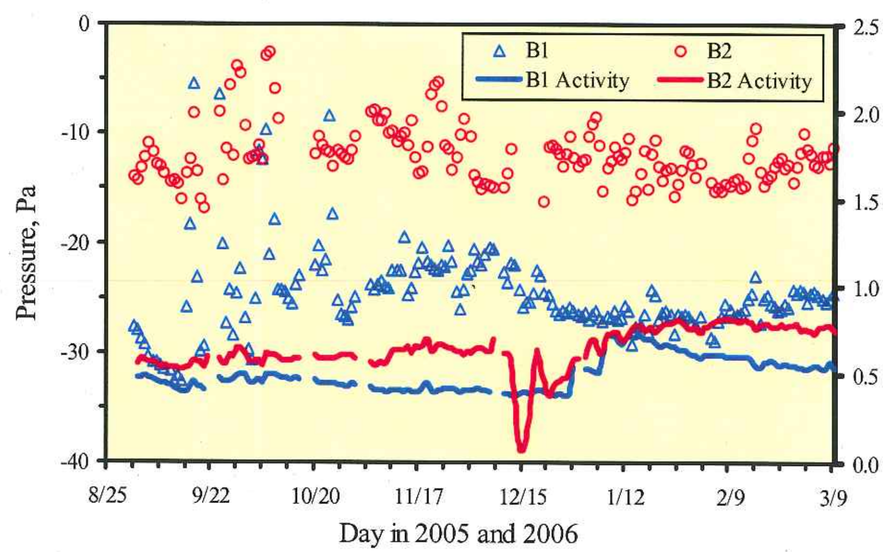

Figure 7. Daily mean barn static pressure and hen activity.

The ADM hen activity of B1 was 0.50 mV, and was 0.64 mV for B2 (Figure 7). The mean B2 activity signal declined to about zero in mid-December 2005 because the spent hens were being removed. The B2 activity increased gradually after the barn was stocked full and the light schedule was lengthened. The barn lighted hours were usually kept shorter for the younger hens. The small peak of activity around December 20, 2005 was due to an extended period of the lighted schedule in B2. The lights of B2 were accidentally kept on for December 20 and 21; thus the higher hen activity signals were detected. The hen activity of B1 was generally lower than B2. However, since the performance of activity sensor was affected by factors such as light intensity, detection angle, and cleanliness of the sensor cover, and because the sensors could not be calibrated for uniform performance, the signals were used only for relevant comparisons within each barn.

Daily mean exhaust air relative humidity (RH) ranged from 47% to 83%, and 42% to 72% for B1 and B2, respectively, while the ambient RH ranged from 44% to 96% (Figure 8). The ADM RH was 76% for ambient air, and 67% and 57% for B1 and B2, respectively. The exhaust RH of B2 appeared to be consistently lower than that of B1. The ADM cage RH of B1 was 53%, and was 54% for B2.

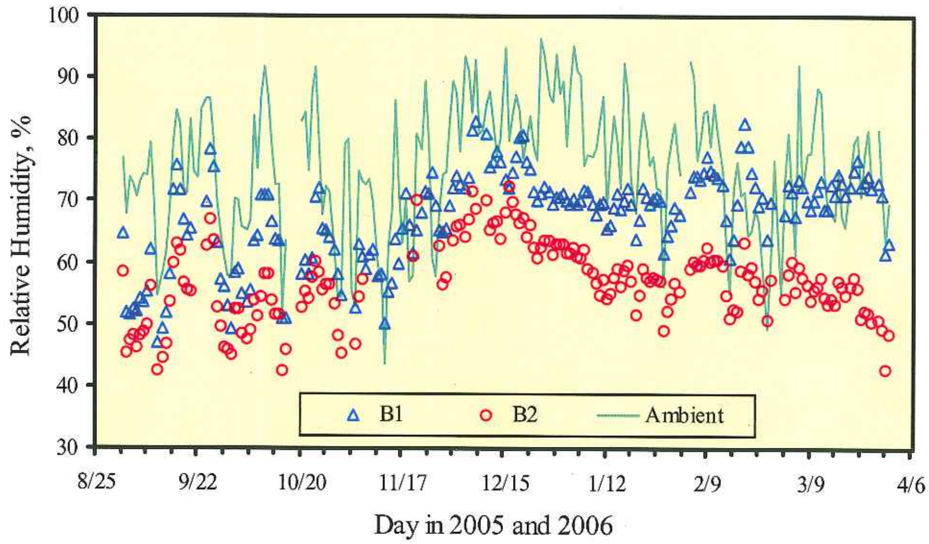

Figure 8. Daily mean barn exhaust and ambient RH.

Results of PM_{10} Measurement

Ambient PM_{10} concentration was 73.8 μg/dsm³ (n= 170 d), and ranged from 13.2 to 188 μg/dsm³ (Figure 9). The ambient PM_{10} concentration was generally higher in warm weather and lower in cold weather. This is most probably due to the high volume of barn exhaust air, though the barn exhaust PM_{10} concentration was lower on the warm days. The other reason was probably due to the sampling location of the ambient TEOM monitor, which was located in between two barns.

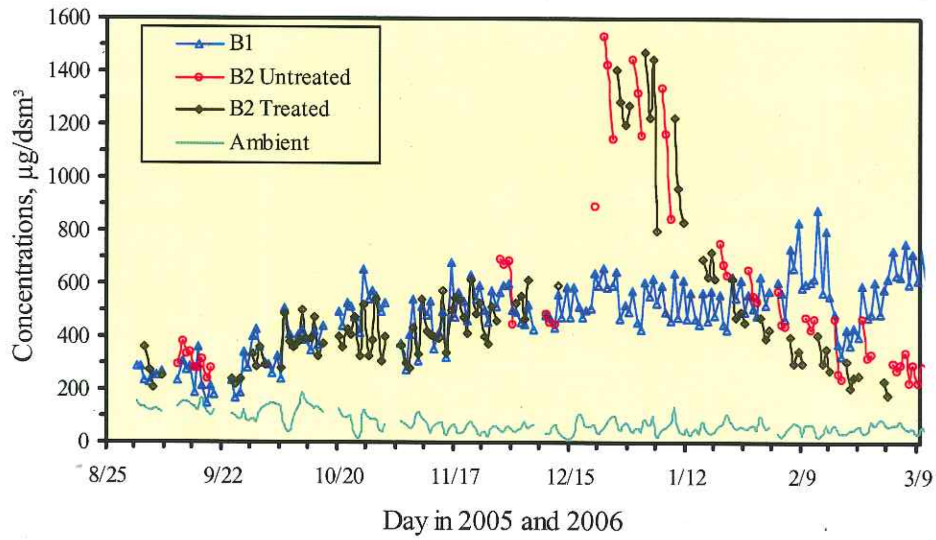

Figure 9. Daily mean PM_{10} concentrations of ambient, B1 exhaust, and treated and untreated B2 exhausts.

Based on paired comparison, the ambient PM_{10} concentration averaged 18.8% of the untreated B1 exhaust concentration. The differences between ambient and B2 exhaust concentration ranged from 3% to 60%, and were generally lower in the warmer days and increased into the winter. This finding agrees with the claims earlier (Lim et al., 2005) that the ambient PM_{10} contributed a significant part of the gross emission, and the ambient concentrations were higher in the warm weather than the cold weather. By having an ambient TEOM monitor for the entire monitoring test, the measurement was greatly improved from the previous Silsoe test, because the net barn emission rates could then be calculated.

The ADM PM_{10} concentration in the B1 exhaust air was 475 μg/dsm³ (n=170, or 92% completeness). In B2, the ADM treated PM_{10} concentration was 494 μg/dsm³ (n=99 d), whereas the ESCS treated ADM was 613 μg/dsm³ (n=46 d). However, the differences between the two barns, or between the treated and untreated differences of B2, cannot be directly attributed to the PM removal of ESCS. Firstly, there were only a few untreated days in the Test 2, and the ESCS was not switched off during weekends after November 28, for the within-B2 treated vs. untreated comparison. Moreover, the ESCS efficacy should be evaluated based on emission rate, because concentration could be affected by ventilation rate. More periodic B2/B1 emission comparisons and reductions of the individual tests are provided later in this report.

The new hens produced higher PM_{10} concentrations and emissions when first moved into B2. The higher-than-normal concentrations and emissions lasted for about five weeks (Figures 9 and 10). This supports the reported higher B2 PM_{10} concentrations from new hens in the previous test (Lim et al., 2005). In this test, the new birds in B2 produced higher PM_{10} concentrations and emissions in December 2005 and January 2006. Both treated and untreated PM_{10} concentrations of B2 were greater than B1 until the end of January 2006, which approximately corresponds to the six weeks of adaptation.

The daily mean ESCS voltages are given in Figure 10. The operating voltage of the ESCS was increased after September 26, 2005. The ESCS power supply unit failure caused the mean ESCS voltage to be lower in December 2005. The ESCS voltage seemed to have a decreasing trend in the second half of the test, even when all of the ESCS lines were repaired after January 15, 2006.

The daily mean PM_{10} emission rates ranged from 1.15 to 11.9 g d^{-1} AU^{-1} for B1, and ranged from 1.29 to 17.2 g d^{-1} AU^{-1} for B2 (including treated and untreated data). The ADM untreated PM_{10} emission rates of B1 was 5.03 g $d^{-1}AU^{-1}$ (14.1 mg d^{-1} hen^{-1}). These values were lower than a typical short-term summertime gross emission of 16±3.4 g d^{-1} AU^{-1} for a high-rise layer barn (Lim et al., 2003). In the previous test with the same barns, the ADM untreated PM_{10} gross emission rates of B1 and B2 were 9.2 and 12.6 g d^{-1} AU^{-1}, respectively (Lim et al., 2005); the higher values were most probably due to the higher ventilation rate applied during the warmer weather. No net emission rate was reported for the two barns in the previous test; however, the emission values would be comparable if considering the 18% ambient concentrations measured in this study.

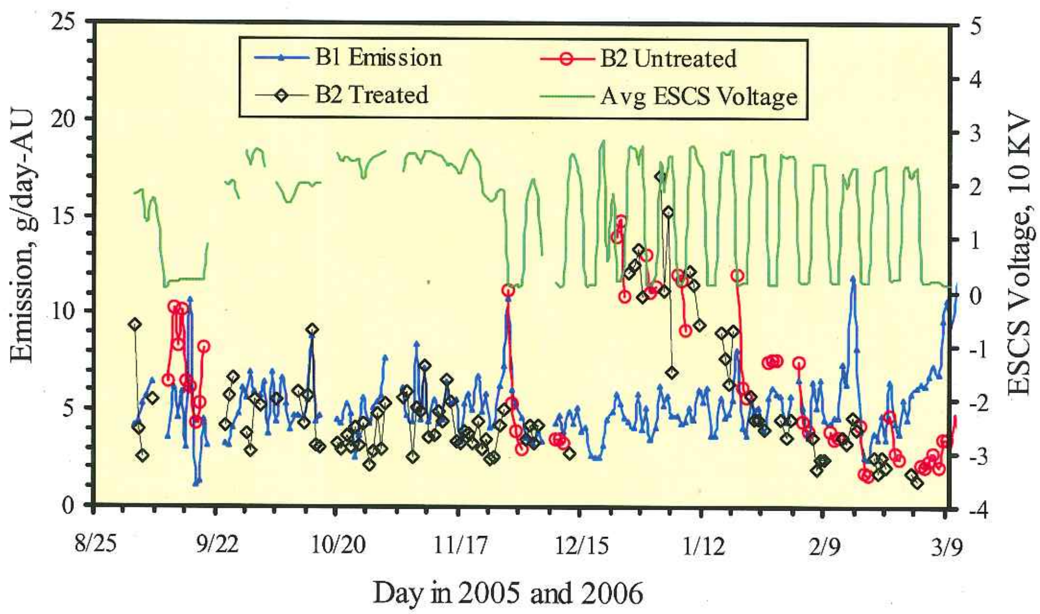

Figure 10. Daily mean PM_{10} emission rates of B1 and B2.

Based on paired B1 and B2 emission rate comparison, the overall (all tests combined) untreated and treated PM_{10} emission rate of B2 averaged 50% and 3% higher than B1, respectively, suggesting an overall 47% reduction. However, the reduction of PM_{10} emission rates was 23% based on measurements with (treated) and without (untreated) the ESCS within B2 for all the tests. The reduction of PM_{10} emission rates was only 12% based on measurements with (treated) and without (untreated) the ESCS within B2, after November 28, 2005 when the ESCS lines were switched off on weekends. However, the reduction was probably hindered by the new flock of hens in B2, because the individual

Test 7 results were as high as 36%. It is thus essential to evaluate the emission rate reduction for each test based on these considerations:

1. There were more treated B2 emission data than untreated data and the treatment schedule was not uniform.
2. There were ESCS power unit failure incidents.
3. Higher-than-normal PM generated by a new flock of hens in B2.

Average daily mean PM_{10} emission rates were 4.4 and 7.3 g d^{-1} AU^{-1} for B1 and B2 during the Alum spraying period of Test 2 (Table 4). Using the mean paired B2/B1 emission comparison of Test 2 as baseline data, the ESCS reduced the PM_{10} emission by 37% and 61% in the Tests 3 and 4, respectively. However, the reduction in Test 4 could be biased by the lack of untreated B2 emission data, and the fact that the September 2005 Test 2 baseline data was only 10 days, and may not be comparable to the October and November 2005 emission rates in Test 4.

Table 4. Summary of ESCS test results for PM_{10}.

Test	Concentration, µg/dsm³				Emission, g d^{-1} AU^{-1}				
	B1	B2 Ctrl.	B2 Trt.	Diff.	B1	B2 Ctrl.	B2 Trt.	Diff.	Reduction
1	259	n/a	272	-4.7%	5.2	n/a	5.3	-2.5%	*48%
2	240	305	n/a	-27%	4.4	7.3	n/a	-65%	baseline
3	267	n/a	260	2.8%	4.5	n/a	5.1	-12%	*37%
4	443	n/a	409	7.7%	5.3	n/a	4.4	18%	*61%
5	511	555	501	2.0%	5.0	4.8	3.5	30%	†5%
6	536	1265	1053	-96%	4.9	12.0	11.0	-124%	†16%
7	560	464	355	37%	5.3	4.7	3.3	38%	†36%

* Reduction was calculated by comparing the paired B1 and B2 emission rates with the Test 2 values.

† Reduction was calculated by comparing the paired treated and untreated emission rates within the test period of B2.

Higher reductions were achieved at certain test periods (48% for the beginning of test, and 36% at the end of test after the new hens had adapted to new environment). Furthermore, the treated daily mean PM_{10} concentration and emission rate of B2 was generally lower than untreated B1 throughout the test (Figures 9 and 10), except when the new flock of hens were moved into B2. The lowest reduction was detected for Test 5, which was probably due to the large amount of PM generated by the new hens.

There was no significant difference (analysis of variance test) between B2 treated and untreated emission rates for the period of November 28, 2005 to March 4, 2006 (partial Test 5, and Tests 6 and 7), which was when the ESCS was switched off periodically for untreated emission measurement (Figure 10). However, the treated emissions were consistently lower after the new hen adaptation period; the reduction averaged 36% in Test 7. The PM removal efficiency of ESCS could have been reduced or affected by the declining ESCS voltages of Line 1 in the last test (Figure 11). The mean voltage of ESCS Line 1 was 19.6 KV in Test 7, while it was 23.8 KV in Test 6. The lower ESCS voltage of Line 1 could have had a more significant effect in reducing the PM removal performance, because this line was located nearest to the South side PM monitors. The voltages of the other three ESCS lines were higher than 23 KV in the last two tests.

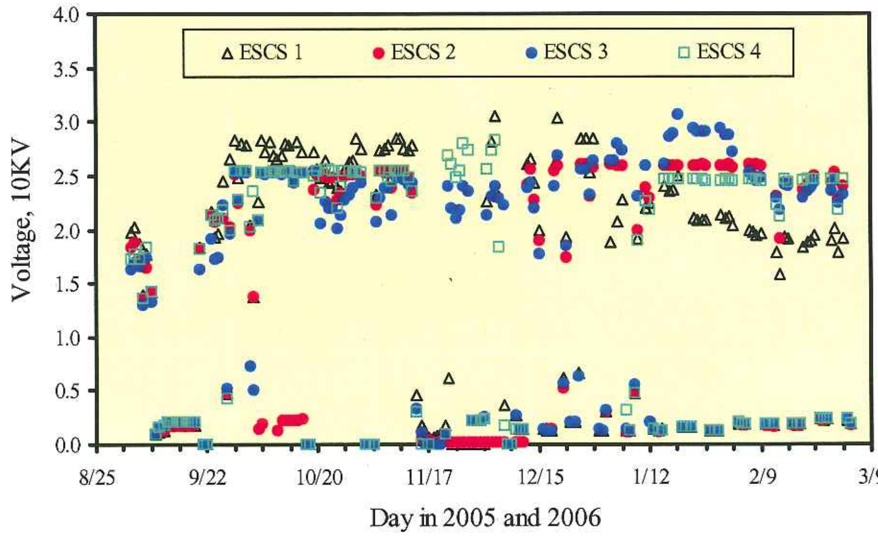

Figure 11. Daily mean TSP concentration and emission rates.

The ESCS performance appeared to be affected by the voltage in the earlier tests. After the ESCS voltage was increased on September 26, the PM reduction was also increased. The emission rate of B1 was 12% lower than B2 in Test 3, but was 18% higher in Test 4. The PM removal efficiency of the ESCS was also hindered by the power unit performance and failure, and by the introduction of a new flock of hens into Barn 2. The overall ESCS performance was expected to be higher if there was no power unit failure, and no flock change in B2.

Results of TSP Measurement

Mean TSP concentration in the exhaust air from 51 measurements at B1 was 3129±599 μg/dsm³. The mean untreated TSP concentration of B2 was 2067±708 μg/dsm³ (n=9), and the mean treated TSP concentration of B2 was 2186 μg/dsm³ (n=38). The overall mean treated TSP concentration of B2 was slightly higher than the untreated concentration, which was probably due to the small number of sample, and the fact that the B2 TSP concentration had a decreasing trend, especially with the new flock of hens (Figure 12). The TSP concentration of B1 was comparable to the values reported last year from the same barn (Lim et al., 2006).

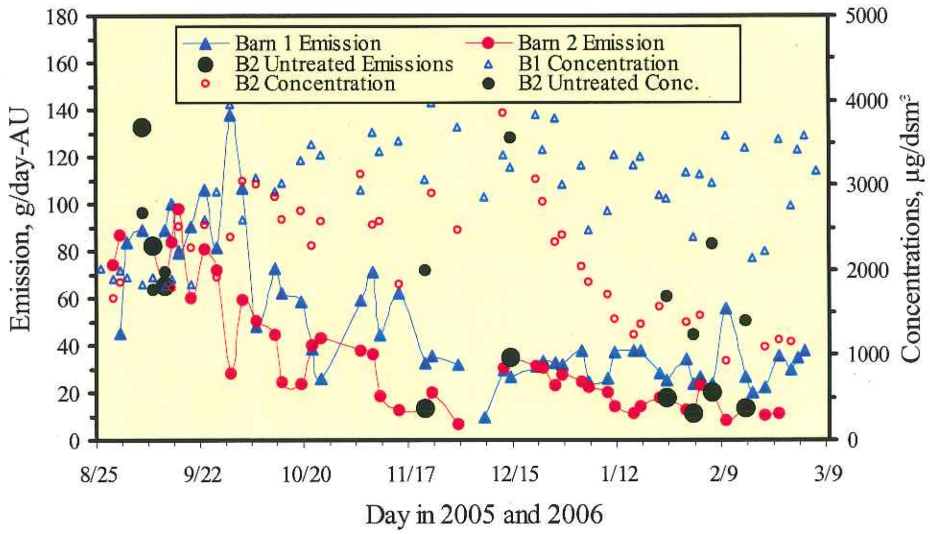

Figure 12. Daily mean TSP concentration and emission rates.

The overall mean TSP gross emissions were 252, 191, and 238 mg/s (49.1, 43.5, and 35.1 g d^{-1} hen^{-1}) for B1, and B2 treated and untreated, respectively (Tables 2 and 3). The TSP emission rate of B2, treated by the ESCS, was 24% lower than the control B1, while the untreated B2 TSP emission was 6% lower than B1, suggesting an overall reduction of 18% from the ESCS treatment. The ESCS-treated TSP emission rate was 19% lower than the untreated value. However, these differences cannot entirely be attributed to the ESCS removal efficiency, because there were only a few replications of untreated TSP measurement in B2. The other factor was that a decreasing trend of TSP concentration and emission rate was noticed for B2, which is similar to the B2 PM_{10} measurement. Thus, the individual test emission differences and reductions are needed to evaluate the ESCS performance (Table 5).

Table 5. Summary of ESCS test results for TSP.

Test	Concentration, µg/dsm³			Emission, g d^{-1} AU^{-1}				
	B1	B2 Ctrl.	B2 Trt.	B1	B2 Ctrl.	B2 Trt.	Diff.	Reduction
1	1989	n/a	1760	86	n/a	80	12%	*12%
2	2128	2051	n/a	88	91	n/a	4%	baseline
3	2888	n/a	2386	94	n/a	79	17%	*22%
4	3397	n/a	2628	63	n/a	45	23%	*33%
5	3615	1992	2402	27	13	13	34%	†2.3%
6	3351	3556	2414	33	35	26	28%	†25%
7	3139	1327	1333	31	12	14	58%	†-12%

* Reduction was calculated by comparing the paired B1 and B2 emission rates with the Test 2 values.

† Reduction was calculated by comparing the paired treated and untreated emission rates within the test period of B2.

Similar to the analyses of PM_{10} emission, the comparison of paired B2 and B1 emission rate in Test 2 (untreated test) was treated as baseline data. In Test 2, the mean gross TSP emission rates were 88 and 91 g d^{-1} hen^{-1} for B1 and B2, respectively, and the difference was 4%. Based on this baseline data, the ESCS reduced the emission by 22% and 33% in Tests 3 and 4. The ESCS performance in Test 5 could be degraded by several power supply unit failures. Since there was only one untreated TSP measurement conducted when the new flock of hens were recently moved into B2, it is not known if the new hens caused the higher TSP concentrations similar to the PM_{10}. In fact, the B2 untreated TSP emission taken on December 23, 2005 was the highest for second half of the test. The B2 TSP concentration and emission for the new hens were comparable to those from B1, although the PM_{10} concentration and emission values of B2 were more than twice of B1 within the test period. This suggests that the new hens only created noticeably higher PM emission for the smaller particulates (PM_{10}).

No reduction was found in the last test when comparing the treated and untreated B2 TSP emission rate, although the treated B2 TSP emission was less than half of B1. The PM removal efficacy of the ESCS could be affected by the lowered Line 1 voltages measured in the last test, as discussed earlier. Unfortunately, there were only four untreated TSP measurements conducted in Test 7. It is not known what caused the B2 TSP concentration and emission to decrease at the second half of the test. Since a similar trend was also found for the PM_{10} data, the possibility of a systematic equipment failure or biasness is very low, especially when the TSP sampling flow rates were measured at the beginning and ending of each sampling event. Although there was no significant TSP reduction found based on the ESCS treatment in B2, the continuous and more frequent PM_{10} measurement data suggest that the ESCS was capable of reducing PM_{10} emission.

Conclusions

1. The average daily mean untreated net emission rates ranged from 1.15 to 11.9 g d^{-1} AU^{-1} for B1 and averaged 5.03 g d^{-1} AU^{-1} (14.1 mg d^{-1} hen^{-1}) for B1.
2. The ESCS reduced PM_{10} emissions by 47% based on overall paired B1 and B2 emission rate comparisons. However, the reduction of PM_{10} emission rates was only 12% based on measurements with (treated) and without (untreated) the ESCS within B2 for the periods when ESCS was switched off on weekends for within-barn comparison. The 12% reduction was probably hindered by ESCS failure and introduction of a new flock of layers into B2. The PM_{10} emission reduction was 36% in Test 7, while the reductions were only 5% (ESCS failure) and 16% (new hens) for the Tests 5 and 6, respectively.
3. The overall mean TSP gross emissions were 252, 191, and 238 mg/s (49.1, 43.5, and 35.1 g d^{-1} hen^{-1}) for B1, and B2 treated and untreated, respectively.
4. The ESCS reduced TSP emissions by 18% based on overall B1 and B2 emission rate comparison. The reduction was 19% based on measurements with (treated) and without (untreated) the ESCS within B2.
5. The overall PM removal efficiency of the ESCS was hindered by equipment failure and performance, and new flock of hens. Higher PM removal efficiency was expected and was found for the individual tests.

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ATTACHMENT 1

OFE Timeline/Chronology For Consent Decree Requirements

Croton Facility - PM Control Plan

CD-Requirement	Date Due	Date Submitted/ Completed	Extension(s) Given	Extension Due Date	Comments
Submit PM control plan for bird variety /higher fat-oil feed change	March 15, 2004	March 15, 2004	No	N/A	OFE submission letter dated May 17, 2004 cites "EPA's April 19, 2004 comment letter on the proposed PM and Ammonia Control Plans".
Complete preliminary M5/17 testing of bird variety/higher fat-oil feed change	May 15, 2004	June 11, 2004	Yes	June 15, 2004	OFE submitted extension request in letter dated May 3, 2004 asking for extension until June 15, 2004. EPA approves extension request in letter dated May 3, 2004. EPA approval condition: NO other subsequent deadlines (in particular the 6-months of secondary testing which includes August, 2004) will be affected. OFE May 3, 2004 letter claims Force Majeur for delay. EPA June 7, 2004 letter to OFE clarifies we do not believe the claims in OFE's May 3, 2004 letter represent Force Majeure events. We indicate we do not need to decide this question since we agreed to extension.
Submit results of preliminary testing	July 12, 2004	August 11, 2004	Yes	August 10, 2004	**LATE** **OFE submitted request for extension AFTER due date (extension request submitted July 23, 2004).**
				August 13, 2004	August 10, 2004 phone call with OFE. Letter dated August 13, 2004, approved this extension date, citing August 10, 2004 call. August 13, 2004 letter says U.S. EPA is entitled to STIPS but will hold in abeyance... "as long as all other future deadlines are met. If any future deadlines are missed, EPA reserves the right to request all penalties associated with this required report". August 13, 2004 letter clarifies proposed changes to PM Plan for Croton to further decrease emissions must be submitted with stack test report. August 13, 2004 letter states OFE must submit proposed changes to Ammonia Plan. August 13, 2004 letter states EPA must receive the prosals (i.e PM and Ammonia Control Plan changes) as soon as possible since paragraphs 11, 16 and 29 in Attachment A require a period of six (6) continuous months of testing that shall include August, 2004.

ATTACHMENT 1 (Cont.)

CD-Requirement	Date Due	Date Submitted/ Completed	Extension(s) Given	Extension Due Date	Comments
Submit results of preliminary testing (cont.)					August 13, 2004 letter clarifies the previous extension was granted with the understanding that six continouos months of testing [for ammonia and PM] would commence according to schedule and include the month of August, 2004.
Submit proposed changes to PM control plan	August 13, 2004	October 29, 2004	No	N/A	**LATE** This is based on August 13, 2004 letter which says submit proposed changes with stack test results. OFE behind in submitting changes, missed August, 2004 test date and had not submitted PM Control alternatives so meeting in DC to get OFE back on track.
			Yes	November 1, 2004	This option was provided in an October 13, 2004 letter which was drafted following an October 5, 2004 meeting with OFE. EPA approved October 29, 2004 plan on December 3, 2004. OFE submitted addendum to approved PM Plan February 1, 2005. EPA approved addendum February 18, 2005.
Begin 6-months of secondary testing which must include August, 2004	August 1, 2004		No	N/A	**LATE**
	January 17, 2005				This date is based on 45-days after EPA approval of October 29, 2004 PM Control Plan (approval letter dated December 3, 2004).
	February 1, 2005		No	N/A	October 13, 2004 letter said testing must begin February 1, 2005 and continue through August 31, 2005. As of March 31, 2005, no preliminary or secondary testing has begun for PM at Croton facility. 114 Response says OFE has installed water impaction system on one fan March 18, 2005. 114 Response says OFE is "...informally evaluating its effectiveness before proceeding with formal testing".
Complete secondary testing	January 31, 2005		No	N/A	**LATE** Original due date based on 6-months of continuous testing under Consent Decree which must include August, 2004.
	August 31, 2005		No	N/A	Due date based on October 13, 2004 letter.

ATTACHMENT 2

OFE Timeline/Chronology For Consent Decree Requirements

Marseilles Facility/Mount Victory Facility - PM Control Plan

CD-Requirement	Date Due	Date Submitted/ Completed	Extension(s) Given	Extension Due Date	Comments
Submit PM control plan for particulate impaction system	March 15, 2004	March 15, 2004	No	N/A	OFE submission letter dated May 17, 2004 cites "EPA's April 19, 2004 comment letter on the proposed PM and Ammonia Control Plans".
Install particulate impaction system at one fan for preliminary testing	July 14, 2004	June 07, 2004	No	N/A	Comments provided April, 2004. Deficient QAPP. Revised plan submitted May 17, 2004. Written approval June 14, 2004.
Begin preliminary testing of particulate impaction system	June 07, 2004	June 07-14, 2004	No	N/A	
Submit results of preliminary testing	June 28, 2004	July 06, 2004	No	N/A	**LATE**
Submit proposed changes to PM control plan	July 05, 2004	None	No	N/A	No changes proposed for PM control plan.
Install particulate impaction system in full barn	August 23, 2004	July 30, 2004	No	N/A	
Begin 6-months of secondary testing which must include August, 2004, for particulate impaction system	August 1, 2004	August 1, 2004	No	N/A	
Begin simultaneous secondary testing at control barn of comparable design, age, chicken population and other relevant parameters	August 1, 2004	August 1, 2004	No	N/A	This completion date assumes barns were similar. Approved QA/QC Plan says bird age is 82 and 70 weeks [i.e., age difference of 12 weeks (page 28)]. Bird age was 72 weeks difference. Typical life expectancy of bird is 120 weeks. Bird variety differs in barns.
Submit summary of validated data-Month 1	September 30, 2004	October 14, 2004	No	N/A	**LATE**
Submit summary of validated data-Month 1-2	October 31, 2004	November 30, 2004	No	N/A	**LATE** October 13, 2004 letter approves submission within 60-days
Submit summary of validated data-Month 1-3	December 31, 2004	December 30, 2004	No	N/A	

ATTACHMENT 2 (cont.)

CD-Requirement	Date Due	Date Submitted/ Completed	Extension(s) Given	Extension Due Date	Comments
Submit summary of validated data-Month 1-4	January 31, 2005	January 31, 2005	No	N/A	
Submit summary of validated data-Month 1-5	February 28, 2005	February 28, 2005	No	N/A	
Complete secondary testing for particulate impaction system	January 31, 2005	January 31, 2005	No	N/A	Not explicit end date in CD. Is 6-months of continuous testing, including August, 2004.
Submit final month of validated data	April 1, 2005		No	N/A	**LATE** As of April 6, 2005, no final month of data has been submitted.
Submit conclusions regarding annual emission rate for particulate impaction system as PM control.	May 1, 2005		No	N/A	
Submit any proposed changes to PM control plan to increase efficacy of system.	May 1, 2005		No	N/A	

ATTACHMENT 3

OFE Timeline/Chronology For Consent Decree Requirements
Marseilles Facility/Mount Victory Facility - Ammonia Control Plan

CD-Requirement	Date Due	Date Submitted/ Completed	Extension(s) Given	Extension Due Date	Comments
for particulate impaction system	March 1, 2004	March 15, 2004	No	N/A	**LATE** OFE submission letter dated May 17, 2004 cites "EPA's April 19, 2004 comment letter on the proposed PM and Ammonia Control Plans". Initial comments April 19, 2004 Revised plan submitted May 17, 2004 Written approval June 14, 2004
Commence bench scale testing of enzyme additive.	July 14, 2004	April 6, 2004	No	N/A	
Submit results of bench scale testing	May 30, 2004	June ~~25~~ 21, 2004	No	N/A	**LATE** EPA disapproved enzyme additive as control, based on bench scale test results.
Submit revisions to ammonia control plan.	July 30, 2004	July 27, 2004	No	N/A	Not explicit date in CD but latest to allow review, approval and testing to include August, 2004. OFE reproposed enzyme additive at higher application rate. Not acceptable since 5-times the recommended application rate used in bench scale testing and NO reductions occurred. Enzyme additive disapproved second time by EPA. **September 9, 2004 letter from EPA to OFE says EPA understands OFE is in violation of the requirement of the Consent Decree, although OFE has not provided the notice of such violation required by paragraph 23(a) of the Consent Decree.**
Commence application of enzyme additive or implement alternative ammonia control system in full barn.	August 1, 2004	December 11, 2004	No	N/A	Implementation due date required to satisfy testing requirement (to include August, 2004). OFE proposed enzyme additive third time (September, 2004). EPA calls meeting in DC with OFE on October 5, 2004. EPA disapproves enzyme additive third time (October 13, 2004) OFE submits revised ammonia control plan (October 13, 2004) which includes implementing new feed additive (Rose Acres Feed). EPA approves Rose Acres feed additive (November 13, 2004).

ATTACHMENT 3 (cont.)

CD-Requirement	Date Due	Date Submitted/ Completed	Extension(s) Given	Extension Due Date	Comments
Begin 6-months of secondary testing which must include August, 2004, for ammonia control.	August 1, 2004	December 11, 2004	No	N/A	**LATE** Due date (based on final written approval, October 13, 2004), would be December 13, 2004.
	February 1, 2005	December 15, 2004			This date is based on new test schedule outlined in ammonia control plan approval letter (October 13, 2004). According to 114 response, testing ended of February 1, 2005. February 15, 2005 through March 28, 2005, according to 114 response . **CD requires 6-months of testing, OFE only did 1.5-months.**
Begin simultaneous secondary testing at control barn of comparable design, age, chicken population and other relevant parameters	August 1, 2004	August 1, 2004	No	N/A	This date assumes barns were similar.
	February 1, 2005	August 31, 2005			Approved QA/QC Plan says bird age is 82 and 70 weeks [i.e., age difference of 12 weeks (page 28)]. Bird age was 72 weeks difference. Typcial life expectancy of a caged layer hen is 120 weeks. Bird variety in barns were different. Approval letter establishes new testing schedule. This due date caused by LATE submission of approvable ammonia control plan.
Submit summary of validated data-Month 1	February 11, 2005	Febuary 28, 2005	No	N/A	**LATE** This due date based on starting ammonia testing December 13, 2004.
Submit summary of validated data-Month 1-2	March 31, 2005	March 21, 2005	No	N/A	This due date based on starting ammonia testing December 13, 2004.
Complete secondary testing for ammonia control system	January 31, 2005 August 31, 2005		No	N/A	This date is original due date under CD. This date based on end date in approval letter.

ATTACHMENT 4

OFE STIPULATED PENALTY WORKSHEET

Violation (Compliance or Reporting)	Violation Description	Total Number of Days Past Due	STIP Category (day)	Days per STIP Category	Penalty for STIP Category	STIPS Totals	Comments
Compliance 1	Submit preliminary testing results for Mt. Victory	8	1st - 14th	8	$500.00	$4,000.00	
	particulate impaction system		15th - 30th		$750.00	$0.00	
			31st - beyond		$1,500.00	$0.00	
Compliance 2	Complete M5/17 testing at Croton for bird variety	27	1st - 14th	14	$500.00	$7,000.00	
	higher fat/oil feed		15th - 30th	13	$750.00	$9,750.00	
			31st - beyond		$1,500.00	$0.00	
Compliance 3	Submit M5/17 testing results for Croton bird variety	31	1st - 14th	14	$500.00	$7,000.00	
	higher fat/oil feed		15th - 30th	16	$750.00	$12,000.00	
			31st - beyond	1	$1,500.00	$1,500.00	
Compliance 4	Submit proposed changes to PM Plan for Croton	110	1st - 14th	14	$500.00	$7,000.00	
	Facility		15th - 30th	16	$750.00	$12,000.00	
			31st - beyond	80	$1,500.00	$120,000.00	
Compliance 5	Commence 6-months of testing at Croton for PM	73	1st - 14th	14	$500.00	$7,000.00	Calculated out through March 31, 2005
	to include August, 2004		15th - 30th	16	$750.00	$12,000.00	(01/17/2005, therefore 73 days)
	(within 45-days of EPA approval-begin 01/17/2005)		31st - beyond	43	$1,500.00	$64,500.00	
Compliance 6	Include Croton barns not converted to belt battery	90	1st - 14th	14	$500.00	$7,000.00	
	in Ammonia Control testing and implementation		15th - 30th	16	$750.00	$12,000.00	
			31st - beyond	60	$1,500.00	$90,000.00	
Compliance 7	Submit Ammonia Control Plan for EPA review	14	1st - 14th	14	$500.00	$7,000.00	
	and approval		15th - 30th		$750.00	$0.00	
			31st - beyond		$1,500.00	$0.00	
Compliance 8	Submit results of bench scale testing under	25	1st - 14th	14	$500.00	$7,000.00	
	Ammonia Control Plan		15th - 30th	11	$750.00	$8,250.00	
			31st - beyond		$1,500.00	$0.00	
Compliance 9	Submit proposed changes to Ammonia Plan for	55	1st - 14th	14	$500.00	$7,000.00	This is based on Paragraph 20 in CD where initial plan
	Mount Victory Facility		15th - 30th	16	$750.00	$12,000.00	was deficient and changed plan did not propose any
			31st - beyond	25	$1,500.00	$37,500.00	changes. Failed to submit from July 30, 2004 until 09/24/2004
Compliance 10	Commence 6-months of testing at Mount Victory		1st - 14th	14	$500.00	$7,000.00	Calculated out through March 31, 2005
	for Ammonia to include August, 2004		15th - 30th	16	$750.00	$12,000.00	Note: Only tested for approximately 1.5 months, then stopped
	(within 60-days of EPA approval-begin 12/13/2004)		31st - beyond	29	$1,500.00	$43,500.00	
Reporting 1	Submit first month of validated PM data for	14	1st - 14th	14	$250.00	$3,500.00	
	Mount Victory Facility		15th - 30th		$500.00	$0.00	
			31st - beyond		$1,000.00	$0.00	
Reporting 2	Submit second month of validated PM data for	30	1st - 14th	14	$250.00	$3,500.00	
	Mount Victory Facility		15th - 30th	16	$500.00	$8,000.00	
			31st - beyond		$1,000.00	$0.00	
Reporting 3	Submit first month of validated Ammonia data for	17	1st - 14th	14	$200.00	$2,800.00	
	Mount Victory Facility		15th - 30th	3	$500.00	$1,500.00	
			31st - beyond		$1,000.00	$0.00	
Reporting 4	Submit first month of validated PM data for	(243)	1st - 14th		$200.00	$0.00	[RESERVED]
	Croton Facility		15th - 30th		$500.00	$0.00	
			31st - beyond		$1,000.00	$0.00	
						$533,300.00	

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGIONS 5
77 WEST JACKSON BOULEVARD
CHICAGO, IL 60604-3590

REPLY TO THE ATTENTION OF:

VIA ELECTRONIC AND U.S. MAIL

March 2, 2007

Mr. Brian M. Babb, Esq.
Keating, Muething & Klekamp, P.L.L.
1400 Provident Tower
One East Fourth Street
Cincinnati, Ohio 45202
bbabb@kmklaw.com

Re: Addendum to February 2, 2007 Letter Approving Ohio Fresh Eggs, LLC's November 1, 2006 Revised Ammonia Emissions Control Design and Implementation Plan for Ohio Fresh Eggs, LLC's Croton, Marseilles, and Mt. Victory, Ohio Facilities (U.S. v. Buckeye Egg Farm, L.P., et al. – Civil Action No. 3:03 CV 7681

Dear Brian:

As we discussed on February 28, 2007, this letter confirms that the U.S. Environmental Protection Agency (EPA) approves the following changes to U.S. EPA's February 2, 2007 letter approving Ohio Fresh Eggs, LLC's (OFE's) November 1, 2006 Revised Ammonia Emissions Control Design and Implementation Plan for Ohio Fresh Eggs, LLC's Croton, Marseilles, and Mt. Victory, Ohio Facilities (Ammonia Control Plan).

We agreed to the following during our discussions:

1. OFE will commence conducting emissions testing using the secondary test methods for ammonia over a continuous three-month period beginning on or about May 1, 2007. This will allow for a change over in the birds in both the test barn and the control barn. The change over will provide birds of comparable age in each barn. The manure pits will be cleaned out and re-bedded with a fresh layer of manure at the same time as the change over. The manure for both the test barn and the control barn will be from the same barn.

2. OFE proposes to implement and test an enhanced fiber diet, as well as five best management practices, to reduce ammonia emissions by fifty percent or more as required by the Consent Decree. OFE intends to use dry distiller grain solids (DDGS) as its enhanced fiber. DDGS is a secondary product of ethanol production from corn.

3. The five approved best management practices OFE will test are identified in our February 2, 2007 letter and include: 1) operation of 40 pit fans in the manure pit; 2) reduction in the amount of crude protein in the feed rations; 3) reduction in the amount of chlorine in the feed ration through the use of bicarbonate; 4) implementation of improved waterline leak management practices; and 5) reducing the number of birds to meet the United Egg Producers (UEP) recommendations.

4. OFE will begin the approved emissions testing for ammonia by implementing the DDGS feed additive and all five best management practices (OFE will start with a reduced number of birds in the test barn - the one with the DDGS fiber enhanced diet - compared to the control barn). This diet and best management practices will be maintained for, at least, the first one and one-half months of testing.

5. OFE will suspend, in series, each of three best management practices (BMPs) during, at most, the second one and one-half months of testing. The BMPs to be suspended are: 1) reduction in the amount of crude protein in the feed rations; 2) reduction in the amount of chlorine in the feed ration through the use of bicarbonate; and 3) operation of 40 pit fans in the manure pit. The order of suspension of the BMPs will be left to OFE's discretion as well as the specific timing of suspension. It is anticipated, however, that OFE will suspend one BMP approximately once every two weeks to allow for the barn to adjust to the change. Once a BMP is suspended, it will remain suspended until after the three consecutive months of testing are complete. For example, if OFE suspends the reduced crude protein BMP first (around the last two weeks in June, if testing begins May 1, 2007), a reduced crude protein will not be reintroduced into the feed until after testing is complete. The second BMP to be removed may be the reduced chlorine in the feed (around the first week in July if testing begins May 1, 2007). At this stage, two of the three BMPs (reduced crude protein and reduced chlorine) will have been suspended and remain suspended until testing is complete. The third and final BMP to be suspended would be operation of the pit fans (around the last two weeks in July if testing begins May 1, 2007). The purpose of this BMP suspension plan is to allow OFE and EPA to review the effectiveness (or lack thereof) of each BMP and its impact on ammonia reductions.

6. OFE will document when each BMP was suspended and include such documentation in the validated raw data and in the final report on ammonia testing. OFE will also review the data and report the apparent effect of the BMP suspension based on the validated data (for example, if the data shows an increase in ammonia emissions – say a five percent increase – occurred after suspension of crude protein, OFE would note that the data indicates reducing crude protein in the bird's diet can provide an additional five percent reduction in ammonia emissions).

Additional Topics Discussed:

OFE raised some concerns about timing of BMP suspension. This is generally referring to concerns if the ammonia emissions reductions are hovering just around 50 percent prior to suspension of a BMP. OFE was concerned that the actual reduction prior to suspension of a certain BMP may meet the 50 percent reduction requirement, but by suspending the BMP at that moment, OFE may not get the total reduction achieved by the BMP. EPA believes that by leaving the specific timing of BMP suspension to OFE's discretion, this concern is addressed.

This letter identifies a schedule of suspension every two weeks as a general time frame, but a few days more or less than two weeks will not be of concern to EPA. However, EPA would not expect OFE to wait for four weeks to suspend one BMP and then, the next day, suspend a second BMP.

Along the same lines, if the implementation of the DDGS and all five BMPs appear to result in ammonia emissions reductions equaling approximately 50 percent or less, OFE need not suspend any BMPs. Such a situation would indicate that the DDGS as well as all five BMPs are necessary to achieve the 50 percent or more reduction required by the Consent Decree. Although not expected, if the implementation of two BMPs have synergistic effects on ammonia emissions (for example by using one BMP, the effectiveness of another in reducing ammonia emissions is decreased), then OFE may choose to suspend one or the other to achieve the maximum ammonia reductions possible.

OFE will modify the quarterly report format to be more in line with the current control technologies being tested and/or implemented (i.e., the electrostatic space charging system - ESCS). Quarterly reports should include updates on the status of the ESCS across all barns at OFE's three facilities (Croton, Marseilles and Mt. Victory), rather than stating the particulate impaction system curtain is not being used. Quarterly reports should also include updates on the belt battery installations occurring at the Croton facility, and the status of implementing the enhanced fiber diet (for the planned testing, as well as once testing is complete – if the enhanced fiber diet is effective in achieving the necessary reductions).

OFE also agreed it would put together a document outlining its proposed "improved waterline leak prevention program" BMP. The document should highlight the current practices as well as the "improvements" being implemented through this BMP. OFE may elect to include updates on the implementation of this BMP across all barns at its facilities in the quarterly reports as well. Although it is a proposed BMP for ammonia control, it may also have impacts on fly problems and other concerns raised by the State in the past. Outside of the Consent Decree context, it seems logical that OFE would desire an improved leak prevention program.

Conclusions:

We approve OFE's proposed ammonia control plan dated November 1, 2006, as set forth in U.S. EPA's February 2, 2007 letter, as amended by this addendum. This approval is granted under the conditions identified above. OFE must realize the proposals made for an enhanced fiber diet and BMPs (bird numbers, fan use, etc.) will all require various records and reports be maintained. There must also be an effective means through which the requirements can be enforced to assure compliance with the fifty percent or more ammonia reduction requirements of the Consent Decree on a continuous basis, once implemented.

If you have any questions regarding this letter or the conditions outlined above, please call me at (312) 886-6237.

Sincerely,

Mary T. McAuliffe
Associate Regional Counsel

cc: Deborah M. Reyher
Kevin Vuilleumier
Cary Secrest
Sanda Howland

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGIONS 5
77 WEST JACKSON BOULEVARD
CHICAGO, IL 60604-3590

REPLY TO THE ATTENTION OF:

VIA ELECTRONIC AND U.S. MAIL

February 2, 2007

Mr. Brian M. Babb, Esq.
Keating, Muething & Klekamp, P.L.L.
1400 Provident Tower
One East Fourth Street
Cincinnati, OH 45202

RE: Review of Ohio Fresh Eggs, LLC's November 1, 2006 Revised Ammonia Emissions Control Design and Implementation Plan for Ohio Fresh Eggs, LLC's Croton, Marseilles, and Mt. Victory, Ohio Facilities (U.S. v. Buckeye Egg Farm, L.P., et al. - Civil Action No. 3:03 CV 7681)

Dear Brian:

This letter acknowledges the U.S. Environmental Protection Agency's (EPA's) receipt of Ohio Fresh Eggs, LLC's (OFE's) November 1, 2006 Revised Ammonia Emissions Control Design and Implementation Plan for Ohio Fresh Eggs, LLC's Croton, Marseilles, and Mt. Victory, Ohio Facilities (Ammonia Control Plan). We have reviewed OFE's Ammonia Control Plan, and approve the proposal under the conditions specified below. This approval is based on the information submitted and our understanding of your proposal as outlined below. Our approval is also dependent on OFE conducting emissions testing using the secondary test methods for ammonia over a continuous three-month period which includes both colder months and warmer months (to the degree the Midwest weather allows). Finally, OFE will need to consider slight revisions to the testing plan as a result of the multiple best management practices (BMPs) it is proposing. OFE must identify the site-specific impacts of each BMP during the three months of testing. We will not require each BMP be tested for three months, but OFE must conduct short-term testing within each of the two barns. The purpose of this requirement is to identify the ammonia reduction benefit of each BMP. We would be happy to discuss this further with you during a call prior to implementing the full three-month test.

Review and Determination:
OFE proposes to implement and test an enhanced fiber diet, as well as certain best management practices, to reduce ammonia emissions by fifty percent or more as required by the Consent Decree. OFE intends to use dry distiller grain solids (DDGS) as its enhanced fiber. DDGS is a secondary product of ethanol production from corn.

OFE also proposes various best management practices (BMPs) as a possible means to reduce ammonia emissions further. OFE's proposal includes the following BMPs:

1) Use of additional pit fans (40 fans in the test building);
2) Improved preventative and corrective measures to reduce leakage from water lines;
3) Reduction of crude protein in the feed rations;
4) Reduced chlorine in feed rations (by substituting sodium bisulfate for chlorine);
5) Compliance with the United Egg Producers guidance to reduce the number of birds within each cage in caged layer houses; and/or
6) Frequent manure turning.

We approve the proposal to use the DDGS as an enhanced fiber within the birds' diet. We understand that DDGS can act as a fiber within a diet and can be received in various concentrations from the supplier. OFE needs to clarify what type of product it intends to receive as DDGS (percent fiber, sugars, etc.) once it is identified, as this can have an impact on the overall ammonia reduction. Any final product make-up must be incorporated into some enforceable document to assure that compliance with the CD ammonia reduction requirements is maintained after testing is complete.

We approve the use of additional pit fans within the test building. OFE must realize that, as part of the overall proposed ammonia control plan, the number of fans operated and how often the fans are operated during the testing will need to become permanent requirements upon completion of the testing. If the necessary reductions are achieved, OFE will need to memorialize the number of fans and operating hours into some enforceable document to assure that compliance is maintained after testing is complete. If OFE wishes to change the number of fans or length of operation, additional testing may be necessary to assure such changes do not impact ammonia reductions in such a way as to fall below the fifty percent level of reductions.

We approve your proposal to implement improved leak preventative/corrective measures to reduce water and moisture from water lines draining into the manure pits. OFE will need to provide a copy of the "improved" preventative/corrective measures plan for review. The "improved" plan should identify what OFE intends to do as well as identify or explain how it will result in successful reductions in leaks, etc. OFE will also need to provide a copy of the current leak preventative/corrective measures plan it is implementing to allow comparison.

We approve your proposal to reduce crude protein in the feed rations for OFE birds by one percent. OFE must provide a validation that the crude protein was reduced by one percent once implemented for testing purposes. If reductions are successful and OFE chooses to implement the crude protein reduction permanently, OFE will need to maintain records which verify the crude protein is maintained at the reduced level. The maintenance of these records must be incorporated as a requirement into some enforceable document to assure they are maintained on an ongoing basis, once testing and implementation are complete.

We approve your proposal to reduce chlorine (i.e., salt) in the feed rations for OFE birds by 0.095 percent. OFE believes that this reduction in the chloride will help reduce the bird's water intake. If this occurs, it could have a possible impact on ammonia reductions by decreasing moisture within the manure (either excreted or leaking from waterline use by the birds). If reductions are successful and OFE chooses to implement the chlorine reduction permanently, OFE will need to maintain records which verify the feed chloride levels are maintained at the reduced level. The maintenance of these records must be incorporated as a requirement into some enforceable document to assure they are maintained on an ongoing basis, once testing and implementation are complete.

We approve your proposal to comply with the United Egg Producer's (UEP's) guidance to reduce the number of birds within each cage in cage layer houses. We note, however, that we do not view this activity as a direct effort by OFE to comply with the Consent Decree ammonia reduction requirements since OFE intended to implement the UEP guidance prior to settlement of this case. Our current understanding of the UEP guidance is that it actually establishes a recommendation to increase the number of square inches within a cage each bird has. In essence, a larger square inch requirement per bird would likely have the effect of reducing the number of birds per cage (or if cages are made larger, then fewer cages would fit within a set cage frame within each barn). If OFE intends to comply with this guidance by increasing the sizes of the cages, barns, and other factors where a reduction in bird numbers does not occur, then it would not be considered an acceptable part of the ammonia control plan. Although the requirements of the UEP guidance will not need to be incorporated into an enforceable document to assure OFE complies with it, the impact of the guidance on the number of birds will need to be incorporated into some enforceable document. We believe a limit on the total number of birds (per year since the guidance is implemented over several years) resulting from implementation of the guidance will be adequate to assure compliance with this aspect of the ammonia control plan. OFE should be aware that an increase in the number of birds (larger cages, larger barns, etc.) beyond the results of implementing the UEP guidance would all require review for purposes of modifications to the OFE facilities. OFE will need to identify the number of birds and track the decrease as the UEP guidance is implemented through 2008. The final number of birds after full implementation of the UEP guidance will need to be incorporated into some enforceable document to assure it is maintained.

We do not approve your proposal to implement more frequent manure turning as part of your ammonia control plan for purposes of the CD. We have multiple concerns with this proposal based on past knowledge and experience with the manure turning. First, manure turning will result in an increase in the amount of PM emitted when such turning events occur. Although PM controls have been approved (the electrostatic space charging system, ESCS) under the Federal Consent Decree and are currently being implemented across all three laying facilities (Croton, Marseilles and Mt. Victory), the resulting increase in PM from manure turning was not investigated during the ESCS testing. Second, a previous study conducted for purposes of a State action on the effectiveness of the manure turning in reducing moisture showed little, if any, effect. Third, by implementing the manure turning, OFE will actually be breaking apart the crust that typically will form over manure which helps reduce PM emissions as well as contain ammonia. By breaking the crust, OFE would, in essence, cause PM and ammonia emission spikes during each turning event, for each barn where it is implemented.

Conclusions:
We approve OFE's proposed ammonia control plan dated November 1, 2006. This approval is granted under the conditions identified above. OFE must realize the proposals made for a higher fiber diet and BMPs, (bird numbers, fan use, etc.) requires that certain records and reports be maintained. There must also be an effective means through which the requirements can be enforced to assure compliance with the fifty percent or more ammonia reduction requirements of the Consent Decree on a continuous basis, once implemented.

If you have any questions regarding this letter or the conditions outlined above, feel free to call me at (312) 886-6237. It may also be useful for us to hold a conference call to discuss this letter, your proposals, and other aspects of the current Consent Decree compliance status.

Sincerely,

Mary T. McAuliffe
Associate Regional Counsel

cc: Deborah M. Reyher
Kevin Vuilleumier
Cary Secrest
Sanda Howland

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION 5
77 WEST JACKSON BOULEVARD
CHICAGO, IL 60604-3590

REPLY TO THE ATTENTION OF:

VIA ELECTRONIC AND U.S. MAIL

November 9, 2006

Mr. Brian M. Babb, Esq.
Keating, Muething & Klekamp, P.L.L.
1400 Provident Tower
One East Fourth Street
Cincinnati, OH 45202
bbabb@kmklaw.com

RE: Follow-Up to Review of Ohio Fresh Eggs, LLC's May 31, 2006 Final Report of the Test of Electrostatic Space Charging System for Ohio Fresh Eggs' Mt. Victory Facility Under Attachment A of Consent Decree (U.S. v. Buckeye Egg Farm, L.P., et al. - Civil Action No. 3:03 CV 7681) and Response to October 17, 2006 Letter

Dear Brian,

On September 13, 2006, we discussed the United States Environmental Protection Agency's (U.S. EPA's) August 3, 2006 letter which reviewed Ohio Fresh Eggs, LLC's (OFE's) May 31, 2006 Final Report of the Test of Electrostatic Space Charging System (the "Final PM Report"). EPA has reviewed this report and approves OFE's PM control plan to use the Electrostatic Charging System (ESCS) as the PM control technology at the Marseilles, Mt. Victory and Croton facilities. This approval is conditioned on OFE ensuring that the installation, operation and maintenance of the ESCS systems are incorporated into a federally-enforceable permits to install or other federally-enforceable document(s) (i.e., State Implementation Plan).

During our September 13th call, you asked for clarification on the following points:

1. air permitting requirements that pertain to OFE;
2. the need for OFE to perform further particulate matter calculations under the Attachment A of the above-captioned Consent Decree; and
3. the date which triggers installation of the ESCS systems at the three facilities.

You subsequently sent us a letter dated October 17, 2006 regarding the permitting requirements and proposing a modified schedule for installation of the ESCS at the Croton, Marseilles, and Mt. Victory layer barn facilities.

First, as we discussed during our September 13, 2006 call, this letter confirms that with respect to the air permitting requirements under the Consent Decree, based on the information provided in your Final PM Report, in accordance with the Consent Decree, Title V permits are not required for the Croton, Marseilles or Mt. Victory facilities at this time. Please note that with respect to the Croton facility, this confirmation is based on the current limitation of 5,688,000 layers at the Croton facility under the existing State Consent Order. Under the Consent Decree and methodology and in accordance with the termination provisions of the Consent Decree, OFE must apply for federally-enforceable permits (that is permits to install, or PTIs, under the Consent Decree), which incorporate the installation, operation and maintenance of the approved PM control technology (i.e., the ESCS) at all barns.

Paragraph 20.d. of Attachment A provides that this Consent Decree may not be terminated until:

"Federally-enforceable permit(s) is/are issued that:

1. imposes operation controls under the synthetic minor permit requirements of the Ohio State Implementation Plan (see Ohio Administrative Code ("OAC") Rules 3745-31-02 and 3745-31-05) or; or

2. includes PM emission control requirements that equal or exceed those required by this Attachment."

Second, regarding additional particulate matter calculations in the Final PM Report, we have determined that additional calculations are not required. However, we do request that the Final PM Report be revised so that the data is expressed in terms of what it is, i.e., lbs PM/hour-chicken. The data is not to be considered an emissions factor.

Third, the date that triggers the installation of the ESCS systems under the Consent Decree is August 3, 2006 which is the date U.S. EPA notified OFE of its approval of the Final PM Report.

With respect to your request for a modified schedule for installation of the ESCS at the Croton, Marseilles, and Mt. Victory layer barn facilities, U.S. EPA approves your request based on the representations made in your October 17th letter.

The approved schedule is as follows:

OFE will commence installation of the ESCS within 60 days of August 3, 2006, and will install the ESCS in one barn per month at either of the Croton, Marseilles, or Mt. Victory facilities for the first four (4) months thereafter (i.e., September 3, October 3, November 3 and December 3, 2006). Four electrostatic particulate ionization lines will be installed on the ceiling in each layer barn.

1. Beginning in the fifth month from the commencement of the ESCS installation (i.e., January 3, 2007), OFE will install the ESCS in one barn per month at the Croton facilities <u>and</u> in one barn per month at either of the Marseilles or the Mt. Victory facilities.

2. OFE will not be required to install the ESCS in any barns being renovated, or scheduled to be renovated, under the State Consent Order or State permits until renovation of the barns are completed. . These barn renovations only affect the Croton facilities.

3. OFE will not be required to install the ESCS in any empty layer barn that is either closed or non-operational. OFE has represented to U.S. EPA that Croton Layer Site Nos. 2 and 3 are not operational, and will not be put back into production until layer barn renovations at those sites are completed. OFE has advised U.S. EPA that currently, there are 16 operating layer barns at the Marseilles facility, 14 operating layer barns at the Mt. Victory facility, 8 operating renovated layer barns at Croton Layer Site No. 1, and 11 operating layer barns at Croton Layer Site No. 4 , 5 layer barns of which have been renovated.

If you have any questions, please call me at (312) 886-6237.

Sincerely,

Mary T. McAuliffe

Mary T. McAuliffe
Associate Regional Counsel

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION 5
77 WEST JACKSON BOULEVARD
CHICAGO, IL 60604-3590

VIA ELECTRONIC AND U.S. MAIL

REPLY TO THE ATTENTION OF:

November 9, 2006

Mr. Brian M. Babb, Esq.
Keating, Muething & Klekamp, P.L.L.
1400 Provident Tower
One East Fourth Street
Cincinnati, OH 45202
bbabb@kmklaw.com

Re: Review of Ohio Fresh Eggs, LLC's June 30, 2006 Final Report of Alum Testing for Ohio Fresh Eggs' Mt. Victory Facility Under Attachment A of Consent Decree (U.S. v. Buckeye Egg Farm, L.P., et al. - Civil Action No. 3:03 CV 7681)

Dear Brian:

This letter acknowledges the U.S. Environmental Protection Agency's (EPA's) receipt of Ohio Fresh Eggs, LLC's (OFE's) June 30, 2006 Final Report of Alum Testing for OFE's Mt. Victory Facility (Final Alum Testing Report). OFE submitted the Final Alum Testing Report in accordance with paragraph 30 of Attachment A to the Consent Decree. On July 18, 2006, OFE and representatives of U.S. EPA participated in a conference call to discuss the test results, and the necessary next steps.

EPA's review of the final report found that the proposed Alum distribution system to control ammonia did not achieve the fifty percent reduction in ammonia emissions required by paragraph 28 of Attachment A to the Consent Decree. Since it did not meet the control requirements of the Consent Decree, EPA can not approve your proposal to use the alum as an ammonia control option. OFE will need to propose alternative ammonia controls in an effort to meet the Consent Decree requirements.

During the July 18, 2006 call, we discussed the possibility of incorporating a new feed additive, being developed by a third party, into OFE's hen diets. Recent data suggests this new feed additive can achieve at least a 50 percent reduction in ammonia at a lower cost than previous feed additives investigated. The data provided to date may be a basis on which we could approve this option as ammonia control under the Consent Decree without OFE needing to perform further bench-scale or 6-months of testing. To obtain such an approval, OFE would need to provide a contractual agreement between OFE and the feed additive provider assuring the correct feed additive was being purchased as well as maintain records showing its proper use/distribution to the hens by OFE staff.

OFE also mentioned it was looking into its own possible diet modifications (not feed additives) for the hens, during the July 18, 2006 call. These diet modifications may be an alternative to OFE purchasing feed additives from a third party. OFE should be aware, however, that new diet modifications developed by OFE, and their impact on ammonia emissions, would need to be studied in accordance with the requirements of the Consent Decree prior to EPA being able to approve such proposed modifications as a control option. If the diet modifications OFE proposes have been studied by outside parties and peer-reviewed scientific papers published discussing the results (in particular ammonia reduction), we may be able to consider that data as part of our review.

Lastly, OFE asked if EPA knew of any egg laying operation which has installed, or is proposing to install, an anaerobic digester. OFE asked about this as another possible option for ammonia controls. EPA is not aware of any egg laying operation which has installed an anaerobic digester, although this does not mean it has not been done.

Typically, anaerobic digesters have been installed at dairy and swine operations which have some type of flush system in place to clean manure and other wastes from barns. If OFE would like to propose an anaerobic digester as a means to control ammonia under the Consent Decree, EPA would be willing to discuss this further. OFE and EPA, however, need to consider how feasible such an option actually is for OFE, in particular because OFE does not use a flush system, has had past moisture problems/fly problems, and odor issues. EPA also needs to consider possible impacts an anaerobic digester could have on other media (outside of air), although as a primarily closed system, proper operation could eliminate such impacts. Several benefits have been found from anaerobic digesters at dairy and swine operations including electricity production, heat/steam production and a high nutrient, dry solids end-product which can be used as a fertilizer.

Please be advised that on Friday, November 3, 2006, we received OFE's Revised Ammonia Emissions Control Design and Implementation Plan. We will contact you once this Revised Plan has been reviewed.

Please call me at (312) 886-6237 if you have any questions.

Sincerely,

Mary T. McAuliffe
Associate Regional Counsel

KMK | Keating Muething & Klekamp PLL
ATTORNEYS AT LAW

Brian M. Babb
Direct Dial: (513) 579-6963
Facsimile: (513) 579-6457
E-Mail: bbabb@kmklaw.com

August 21, 2006
Ms. Mary T. McAuliffe
Associate Regional Counsel
United States Environmental Protection Agency
Region 5
77 West Jackson Boulevard
Chicago, Illinois 60604-3590
Re:
Ohio Fresh Eggs - Addendum to May 31, 2006 Final Report of Test of Electrostatic Space Charge System

Dear Mary:

As requested in your August 3, 2006 letter, enclosed is Ohio Fresh Eggs' Addendum to the May 31, 2006 Final Report of the Test of the Electrostatic Space Charge System for Ohio Fresh Eggs' Mt. Victory Facility, which contains annualized emissions data based on the tested effectiveness of the Electrostatic Space Charge System (ESCS) at Ohio Fresh Eggs' (OFE) Mt. Victory facilities. As noted in the Addendum, the extrapolated TSP emissions data indicates that the Prevention of Significant Deterioration (PSD) 250 ton threshold for total particulate matter (TSP) would be exceeded from uncontrolled-layer barns containing 9.9 million birds. In contrast, the extrapolated data shows that the 250 ton TSP threshold would be exceeded from ESCS-controlled layer barns containing 12.2 million birds. OFE's Croton, Mt. Victory, and Marseilles facilities do not appear to exceed the 250 ton TSP emission threshold, either as uncontrolled or ESCS-controlled layer barns.

Based upon the PM_{10} and TSP emissions data, and the existing number of birds, the ESCS-controlled layer barns at the Croton facilities would not exceed either the 100 ton, or 250 ton, TSP thresholds, respectively, under the federal Consent Decree for Title V and PSD permitting purposes under the federal Clean Air Act. As of August 5, 2006, 1,190,879 layers were at Croton Layer Site No. 1, and 1,181,464 layers were at Croton Layer Site No. 4, for a total of 2,372,343 layers. Croton Layer Site Nos. 2 and 3 have not contained any birds since August-September 2005 As you know, under the State Consent Order in *Ohio v. Buckeye Egg Farm*, the total number of layers allowed at the Croton facilities is 5,688,000 layers, which would prevent the 250 ton TSP threshold from being exceeded in the Croton uncontrolled or ESCS-controlled layer barns. In ESCS-controlled layer barns, 16.0 million layers would be needed to exceed the 100 ton PM_{10} annual threshold. Annual PM_{10} emissions in

Brian M. Babb

By:

Brian M. Babb

Enclosures
cc:
Mr. Donald C. Hershey

Dr. Al Heber

1719509.1

KMK | Keating Muething & Klekamp PLL
ATTORNEYS AT LAW

BRIAN M. BABB
DIRECT DIAL: (513) 579-6963
FACSIMILE: (513) 579-6457
E-MAIL: BBABB@KMKLAW.COM

August 21, 2006

Ms. Mary T. McAuliffe
Associate Regional Counsel
United States Environmental Protection Agency
Region 5
77 West Jackson Boulevard
Chicago, Illinois 60604-3590

Re: Ohio Fresh Eggs - Addendum to May 31, 2006 Final Report of Test of Electrostatic Space Charge System

Dear Mary:

As requested in your August 3, 2006 letter, enclosed is Ohio Fresh Eggs' Addendum to the May 31, 2006 Final Report of the Test of the Electrostatic Space Charge System for Ohio Fresh Eggs' Mt. Victory Facility, which contains annualized emissions data based on the tested effectiveness of the Electrostatic Space Charge System (ESCS) at Ohio Fresh Eggs' (OFE) Mt. Victory facilities. As noted in the Addendum, the extrapolated TSP emissions data indicates that the Prevention of Significant Deterioration (PSD) 250 ton threshold for total particulate matter (TSP) would be exceeded from uncontrolled-layer barns containing 9.9 million birds. In contrast, the extrapolated data shows that the 250 ton TSP threshold would be exceeded from ESCS-controlled layer barns containing 12.2 million birds. OFE's Croton, Mt. Victory, and Marseilles facilities do not appear to exceed the 250 ton TSP emission threshold, either as uncontrolled or ESCS-controlled layer barns.

Based upon the PM_{10} and TSP emissions data, and the existing number of birds, the ESCS-controlled layer barns at the Croton facilities would not exceed either the 100 ton, or 250 ton, TSP thresholds, respectively, under the federal Consent Decree for Title V and PSD permitting purposes under the federal Clean Air Act. As of August 5, 2006, 1,190,879 layers were at Croton Layer Site No. 1, and 1,181,464 layers were at Croton Layer Site No. 4, for a total of 2,372,343 layers. Croton Layer Site Nos. 2 and 3 have not contained any birds since August-September 2005 As you know, under the State Consent Order in *Ohio v. Buckeye Egg Farm*, the total number of layers allowed at the Croton facilities is 5,688,000 layers, which would prevent the 250 ton TSP threshold from being exceeded in the Croton uncontrolled or ESCS-controlled layer barns. In ESCS-controlled layer barns, 16.0 million layers would be needed to exceed the 100 ton PM_{10} annual threshold. Annual PM_{10} emissions in ESCS-controlled layer barns would not exceed 100 tons at either Croton Layer Site Nos. 1 or 4, Very truly yours,

KEATING MUETHING & KLEKAMP PLL

By: Brian M. Babb
Brian M. Babb

Enclosures

cc: Mr. Donald C. Hershey
Dr. Al Heber

1719509.1

Addendum to the Final Report

Effects of Electrostatic Space Charge System on Particulate Matter Emissions from High Rise Layer Barn

to

Ohio Fresh Eggs, LLC

11492 Westley Chapel Rd, Croton, OH 43013

by

Albert J. Heber, Teng Teeh Lim, Ji-Qin Ni, Samuel M. Hanni, Claude A. Diehl, Chaoyuan Wang, and Lingying Zhao

Agricultural and Biological Engineering Department

Purdue University

225 S. University St.

West Lafayette, IN 47907

Phone: 765-494-1214

August 17, 2006

Table 1. Monthly averages of ambient temperature and emission values.

Month	Temperature* (°C)	PM_{10} Emission ** g d^{-1} AU^{-1}	Days/month day	Total emission g AU^{-1}
January	-4.4	4.79	31	148
February	-2.8	4.88	28	137
March	2.8	5.18	31	160
April	8.3	5.48	30	164
May	14.4	5.81	31	180
June	19.4	6.08	30	182
July	21.7	6.20	31	192
August	20.6	6.14	31	190
September	17.2	5.96	30	179
October	10.6	5.60	31	174
November	5.0	5.30	30	159
December	-1.1	4.97	31	154

* http://www.weather.com/weather/wxclimatology/monthly/USOH0549

** Predicted based on linear regression equation in figure 1.

Based on the B1 temperature-weighted annual net PM_{10} emission rate, and having a mean value of 441 AU (156,571 birds) during the test, 39.9 million hens would emit 250 tons/year of PM_{10} emissions, or 16.0 million hens would emit 100 ton/year of PM_{10} emissions. Once the ESCS was applied, it would take at least one-third more birds to produce a similar amount of PM per year.

The ADM PM_{10} net emission rate of B1 (untreated) was 5.03 g $d^{-1}AU^{-1}$ (14.1 mg d^{-1} hen^{-1}), while the temperature-weighted emission rate was 5.53 g $d^{-1}AU^{-1}$, which is comparable to the values reported in the previous test with the same barns. The ADM untreated PM_{10} gross emission rates of B1 and B2 were 9.2 and 12.6 g d^{-1} AU^{-1}, respectively (Lim et al., 2005). Considering the 18% ambient concentrations measured in this test, the net emission values would be comparable if there had been ambient concentration measurement in the previous test.

Based on the TSP/PM_{10} ratio of 6.5 for B1, which was determined during simultaneous measurements, it is estimated that it would take 9.9 million birds to emit 250 tons of TSP per year based on barn 1 measurements. Since the ESCS reduced the TSP emission rate by 19%, it would take 12.2 million hens to emit over 250 tons of TSP per year if the buildings were installed with the ESCS; and it would take 4.9 million hens to emit 100 tons of TSP per year with ESCS installed.

Confirmation Report – Memory Send

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FACSIMILE REQUEST AND COVER SHEET

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION 5
AIR AND RADIATION DIVISION
77 WEST JACKSON BOULEVARD
CHICAGO, ILLINOIS 60604

TO: Christine Swetz

OFFICE: RAPCA

PHONE #: (937) 496-7541 MACHINE #: (937) 225-3486

FROM: Kevin Vuilleumier

ORGANIZATION: AIR ENFORCEMENT AND COMPLIANCE ASSURANCE BRANCH

PHONE #: (312) 886-6188 MACHINE #: (312) 353-8289

DATE: 04/11/2007 NUMBER OF PAGES INCLUDING THIS COVER SHEET 21

COMMENTS: ammonia control plan approval letters, original ESGS approval letter & STIP letter

INFORMATION FOR SENDING FACSIMILE MESSAGES TO THE AIR ENFORCEMENT AND COMPLIANCE ASSURANCE BRANCH

EQUIPMENT	FACSIMILE NUMBER	VERIFICATION NUMBER
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FACSIMILE REQUEST AND COVER SHEET

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION 5
AIR AND RADIATION DIVISION
77 WEST JACKSON BOULEVARD
CHICAGO, ILLINOIS 60604

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UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION 5
77 WEST JACKSON BOULEVARD
CHICAGO, IL 60604-3590

REPLY TO THE ATTENTION OF

VIA ELECTRONIC AND U.S. MAIL

August 3, 2006

Mr. Brian M. Babb, Esq.
Keating, Muething & Klekamp, P.L.L.
1400 Provident Tower
One East Fourth Street
Cincinnati, OH 45202
bbabb@kmklaw.com

RE: Review of Ohio Fresh Eggs, LLC's May 31, 2006 Final Report of the Test of Electrostatic Space Change System for Ohio Fresh Eggs' Mt. Victory Facility Under Attachment A of Consent Decree (U.S. v. Buckeye Egg Farm, L.P., et al. - Civil Action No. 3:03 CV 7681)

Dear Brian:

This letter acknowledges the U.S. Environmental Protection Agency's (EPA's) receipt of Ohio Fresh Eggs, LLC's (OFE's) May 31, 2006 Final Report of the Test of Electrostatic Space Charging System (the "Final PM Report"). EPA has reviewed this report and approves OFE's PM control plan to use the Electrostatic Charging System (ESCS) as the PM control technology at the Marseilles, Mt. Victory and Croton facilities.

OFE submitted its Final PM Report on the ESCS as required by Section I, paragraph 17 of Attachment A to the Consent Decree. While OFE's Final PM Report provides the mean period emission rate for Barns 1 and 2 for the measurement period, it does not extrapolate that data to determine the annual emissions rate. Paragraph 17 of Attachment A to the Consent Decree requires OFE to submit its conclusions regarding the annual emission rate. Accordingly, OFE is required to submit this calculation to EPA within fourteen days of receipt of this letter as an addendum to the Final PM Report. These calculations must be conducted in accordance with Exhibit 3 to the Consent Decree. Exhibit 3 requires an evaluation of the temperature-weighted emission rate followed by total annual emissions based on historical temperature data.

OFE shall install the ESCS at the Marseilles, Mt. Victory and Croton facilities in accordance with Section C (Implementation) of Attachment A to the Consent Decree. The specific conditions of implementation will be based on EPA's final review of the annual emissions as calculated above, and are summarized below.

Annual emissions less than 250 tons per year

Marseilles and Mt. Victory facilities (Paragraph 19 of Attachment A to the Consent Decree): OFE shall commence installation of the ESCS in all the layer barns at the Marseilles and Mt. Victory facilities within 60 days of transmission to EPA of annual emissions data showing annual emissions less than 250 tons per year (tpy). OFE shall complete the installations within one year of submitting such annual emissions data. OFE shall submit applications for any applicable federally enforceable limit that may be triggered by emissions less than 250 tpy based on the approved annual emissions calculations conducted in accordance with Exhibit 3 of the Consent Decree up to 120 days after this approval.

Croton facility (Paragraphs 23.b. and 24 of Attachment A to the Consent Decree): OFE shall install the ESCS (alternative/additional controls to original proposal of bird variety change and feed additive) in all barns at the Croton facility at an average rate of one barn every thirty (30) days. OFE shall submit applications for any applicable federally enforceable limit that may be triggered by emissions less than 250 tpy based on the approved annual emissions calculations conducted in accordance with Exhibit 3 of the Consent Decree up to 120 days after this approval.

Annual emissions greater than 250 tons per year

Marseilles and Mt. Victory facilities (Paragraph 21 of Attachment A to the Consent Decree): OFE may elect to either: (1) propose alternative or additional controls to further reduce PM emissions at the affected facilities, or (2) commence installation of the ESCS at all barns at the Marseilles and Mt. Victory facilities within 60 days of transmission to EPA of annual emission data showing annual emissions greater than 250 tpy and apply for a federally enforceable permit to include PM emission control requirements equal to or exceeding those required by this approval and the Consent Decree.

Croton facility (Paragraphs 23.b. and 24.b. of Attachment A to the Consent Decree): OFE shall install the ESCS (alternative/additional controls to original proposal of bird variety change and feed additive) in all barns at the Croton facility at an average rate of one barn every thirty (30) days. OFE shall apply for a federally enforceable permit to include PM emission control requirements equal to or exceeding those required by this approval and the Consent Decree.

Please call me at (312) 886-6237 if you have any questions.

Sincerely,

Mary T. McAuliffe
Associate Regional Counsel

cc: Deborah M. Reyher
Kevin Vuilleumier
Cary Secrest
Sanda Howland

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION 5
77 WEST JACKSON BOULEVARD
CHICAGO, IL 60604-3590

REPLY TO THE ATTENTION OF:

VIA ELECTRONIC AND EXPRESS MAIL

April 21, 2005

Mr. Brian M. Babb, Esq.
Keating, Muething & Klekamp, P.L.L.
1400 Provident Tower
One East Fourth Street
Cincinnati, OH 45202
bbabb@kmklaw.com

RE: Stipulated Penalties Demand, U.S. v. Buckeye Egg Farm, L.P., et al.
Civil Action No. 3:03 CV 7681

Dear Mr. Babb:

Over the past nine months, the United States Environmental Protection Agency (EPA) has worked diligently with Ohio Fresh Eggs, LLC (OFE) to remedy OFE's repeated failures to comply with the requirements of the above-captioned Consent Decree. Those repeated efforts have been unavailing, as OFE remains in substantial noncompliance with the Consent Decree. At this juncture, EPA, in consultation with the United States Department of Justice, has determined that OFE's failure to comply is so egregious that stipulated penalties as provided under the Consent Decree must be assessed. This letter summarizes some of OFE's most flagrant violations of the Consent Decree to date. Please note that OFE continues to violate the Consent Decree and stipulated penalties shall continue to accrue until such time as OFE complies with the Consent Decree.

Attachments 1, 2 and 3 present, in table summary, a timeline of requirements applicable to OFE's Croton, Marseilles and Mt. Victory facilities, as follows: Attachment 1 sets forth certain requirements pertaining to the particulate matter control plan at the Croton facility; Attachment 2 sets forth certain requirements pertaining to the particulate matter control plan at the Marseilles facility and Mt. Victory facility; and Attachment 3 sets forth certain requirements pertaining to the ammonia control plan at the Marseilles facility and Mt. Victory facility.

Attachment 4 itemizes each element of our stipulated penalty demand by requirement and related dollar amount. With respect to Attachment 4, please note that EPA has only calculated a stipulated penalty total through March 31, 2005. EPA reserves the right to seek stipulated penalties for the additional days of violation that have occurred after March 31, 2005, if OFE continues to fail to comply with the requirements of the Consent Decree. Please be advised that EPA has calculated stipulated penalties using a conservative approach (i.e., an approach more favorable to OFE than we could otherwise use). If OFE continues to fail to comply with the requirements of the Consent Decree, EPA reserves its right to recalculate the stipulated penalties using other dates and formulas.

Briefly, OFE's most glaring violations include the following: the failure to timely and appropriately conduct any of the testing required by the Consent Decree at the Croton facility, except for the required Method 5/17 testing; the failure to submit and implement in a timely manner an acceptable plan to reduce ammonia emissions from the Marseilles and Mt. Victory facilities; and the failure to comply with the testing protocol OFE submitted to reduce ammonia emissions at the Marseilles and Mt. Victory facilities.

In reviewing OFE's compliance with the Consent Decree, it is useful to review the terms of the Consent Decree. As OFE is aware, the Consent Decree required OFE to commence no later than August 2004 the required six continuous months of approved particulate matter testing, also referred to as secondary method testing, or Silsoe testing, and ammonia controls testing at OFE's Marseilles or Mt. Victory facility; and to commence no later than August 2004 the required six continuous months of approved particulate matter testing at the Croton facility. (See, for example, Paragraph I.B.16 of Attachment A to the Consent Decree which requires OFE to commence six continuous months of particulate matter testing emission testing at the Croton facility, and to ensure that such testing includes the month of August 2004; see a similar provision for the Marseilles or Mt. Victory facility at Paragraph I.B.11. of Attachment A to the Consent Decree; see also Paragraph I.B.29 of Attachment A to the Consent Decree which requires OFE to implement an approved Ammonia Plan to reduce ammonia emissions and to commence continuous testing for six months, including the month of August 2004; see also the first paragraph of EPA's May 3, 2004 letter allowing for extensions of time to commence testing "as long as other subsequent deadlines will not be affected, and, in particular, the six months of continuous testing will still include the month of August 2004 as required by the Consent Decree.")

One of the primary reasons that the Consent Decree required testing to include the month of August 2004 in the six continuous months of particulate matter testing at the Croton facility and the six months of continuous particulate matter and ammonia emission testing at the Marseilles or Mt. Victory facilities is the potential health risks to the surrounding community stemming from OFE's elevated emission levels of ammonia and particulate matter. August is the month during which ambient levels of these contaminants typically peak in the surrounding community. OFE's failure to test and control these emissions as contemplated by the Consent Decree means that the people who live near OFE's Croton, Marseilles and Mt. Victory facilities will continue to be subject to these uncontrolled ammonia and particulate matter emissions.

With respect to required particulate matter testing at its Croton facility, shortly before one of the first requirements of the Consent Decree became due, on May 3, 2004, OFE indicated that its failure to perform required Method 17 particulate matter testing for one month at the Croton facility was due to a force majeure event. By letter dated June 7, 2004, EPA advised OFE that it did not accept OFE's claim of force majeure.

Ammonia testing is another Consent Decree requirement that OFE has failed to meet. During a June 8, 2004 call with you and OFE's expert, Dr. Albert Heber, EPA learned that bench scale testing of Eco-Cure™, which OFE proposed to use to reduce ammonia emissions, indicated that this product had no effect on reducing ammonia emissions. We discussed alternatives to Eco-Cure™, including the use of aluminum sulfate and dietary modification to control emissions. Our concerns about the ineffectiveness of Eco-Cure™ were reiterated in EPA's June 14, 2004 letter. Yet, in a July 27, 2004 letter, OFE requested that EPA approve Silsoe testing of Eco-Cure™ asserting that the bench-scale test was not representative because, in part, not enough of the product was applied, even though the initial application rates were five times higher than recommended by the manufacturer. OFE submitted this request to EPA just four days before August 1, 2004, the month that OFE was required by the Consent Decree to include in its six month test. Then, OFE submitted its Revised Ammonia Emissions Control Design and Implementation Plan, dated August 2004, again proposing to use Eco-Cure™ as its control strategy. It was not until September 24, 2004, that OFE submitted a revised ammonia plan for Silsoe testing of a feed additive that, unlike Eco-Cure™, was based on a sound scientific theory and test data indicating the potential for significant reductions in ammonia emissions. OFE's deliberate and repeated submission of an ineffective ammonia control product already disapproved by EPA constitutes a failure to comply with the Consent Decree. To further compound matters, OFE apparently stopped using the approved feed additive after one and a half months and therefore failed to complete six months of testing.

As OFE continued to submit requests for extensions, by letter dated August 13, 2004, EPA finally advised OFE that no further extensions to requirements under the Consent Decree would be granted, and that EPA was holding in abeyance stipulated penalties that otherwise could have been assessed for failure to timely submit the Method 17 stack test report "...as long as all other future deadlines are met. If any future deadlines are missed, EPA reserves the right to request all stipulated penalties associated with this required report."

On October 12, 2004, OFE notified EPA that it was out of compliance with the Consent Decree. On April 5, 2005, in response to a Clean Air Act Section 114 request for information, OFE advised EPA that it had stopped performing the Silsoe testing at its Mt. Victory facility on February 1, 2005.

As OFE has made little effort to comply with the requirements of the Consent Decree, EPA has determined that it is appropriate to seek stipulated penalties in the amount of $533,300. (See Attachment 4.)

Pursuant to paragraphs 43 and 47 of the Consent Decree, payment must be made within thirty (30) days of receipt of this letter using the EFT instructions previously provided by the Financial

Litigation Unit of the U.S. Attorney's Office for the Northern District of Ohio, Western Division. Please see paragraph 35 of the Consent Decree for specific payment information.

In addition to reserving all rights to (1) seek penalties for violations that continue and/or occur after March 31, 2005, and (2) recalculate our stipulated penalty demand for violations that occurred prior to March 31, 2005, as stated above, EPA is also continuing to review OFE's compliance with other requirements of the Consent Decree, and reserves all rights to seek additional stipulated penalties for any other violations of the Consent Decree that may be uncovered.

Please call me if you have any questions at (312) 886-6237.

Sincerely,

Mary T. McAuliffe

Mary T. McAuliffe
Associate Regional Counsel

Enclosures
Attachment 1 - OFE Timeline/Chronology (Croton Facility - PM Control Plan)
Attachment 2 - OFE Timeline/Chronology (Marseilles/Mt. Victory - PM Control Plan)
Attachment 3 - OFE Timeline/Chronology (Marseilles/Mt. Victory - NH3 Control Plan)
Attachment 4 - Stipulated Penalty Worksheet

KMK | Keating Muething & Klekamp PLL

ATTORNEYS AT LAW

BRIAN M. BABB
DIRECT DIAL: (513) 579-6963
FACSIMILE: (513) 579-6457
E-MAIL: BBABB@KMKLAW.COM

RECEIVED
JUL 03 2006
AIR ENFORCEMENT BRANCH,
U.S. EPA, REGION 5

June 30, 2006

Via UPS
Chief, Environmental Enforcement Section
Environment and Natural Resources Division
U.S. Department of Justice
601 D. Street, N.W.
Mailroom 2121
Washington, D.C. 20004

Via UPS
Compliance Tracker
Air Enforcement and Compliance Assurance Branch
U.S. Environmental Protection Agency
Region 5, AE-17J
77 West Jackson Boulevard
Chicago, Illinois 60604

Via UPS
Director, Office of Regulatory Enforcement
Office of Enforcement and Compliance Assurance
U.S. Environmental Protection Agency
Mail Code 2241A
1200 Pennsylvania Avenue, N.W.
Washington, D.C. 20460

Via E-Mail
Mr. Kevin L. Vuilleumier, Environmental Engineer
Air Enforcement and Compliance Assurance Branch
U.S. Environmental Protection Agency
Region 5-AE-17J
77 West Jackson Boulevard
Chicago, Illinois 60604-3507

Via E-Mail
Mr. Cary Secrest
U.S. Environmental Protection Agency
Ariel Rose Building, Room 2119
1200 Pennsylvania Avenue, N.W.
Washington, D.C. 20004

Via E-Mail
Ms. Mary T. McAuliffe
Associate Regional Counsel
U.S. Environmental Protection Agency
Region 5
77 West Jackson Boulevard
Chicago, Illinois 60604-3590

RE: United States v. Buckeye Egg Farm, L.P., et al. – Civil Action 3:03 CV 7681. Final Report of Alum Testing for Ohio Fresh Eggs' Mt. Victory Facility

Dear Sir/Madam:

As required under Attachment A of the Consent Decree in the above-referenced matter, I have enclosed a copy of the Final Report of the Effects of Aluminum Sulfate and Aluminum chloride on Ammonia Emissions from High Rise Layer Barns for Ohio Fresh Eggs' Mt. Victory Facility. Also enclosed is Ohio Fresh Eggs' Certification for this Report.

50th ANNIVERSARY 1954-2004

Should you need additional information, please contact me. Thank you for your consideration of this matter.

Very truly yours,

KEATING MUETHING & KLEKAMP PLL

By: Brian Babb
Brian M. Babb

Enclosures

cc: Mr. Donald C. Hershey
Dr. Albert J. Heber

1671363.1

CERTIFICATION

I certify under penalty of law that this document and any attachments to it were prepared under my direction or supervision in accordance with a system designed to ensure that qualified personnel properly gather and evaluate the information submitted. Based on my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing and willful submission of a materially false statement.

OHIO FRESH EGGS, LLC

Donald C. Hershey

Donald C. Hershey, Manager

1232938.1

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U.S. EPA, REGION 5

Effects of Aluminum Sulfate and Aluminum Chloride Applications on Ammonia Emissions from High-Rise Layer Barn

Final Report

to

Ohio Fresh Eggs, LLC

11212 Croton Road, Croton, OH 43013

by

Albert J. Heber, Teng Teeh Lim, Ji-Qin Ni, Samuel M. Hanni, Claude A. Diehl, Chaoyuan Wang, and Lingying Zhao

Agricultural and Biological Engineering Department

Purdue University

225 S. University St.

West Lafayette, IN 47907

Phone: 765-494-1214

June 30, 2006

Effects of Aluminum Sulfate and Aluminum Chloride Applications on Ammonia Emission from a High-Rise Layer Barn

Albert J. Heber, Teng Teeh Lim, Ji-Qin Ni, Samuel M. Hanni, Claude A. Diehl, Chaoyuan Wang, and Lingying Zhao

Abstracts

Ammonia (NH_3) emission rates were measured at two 169,000-hen capacity high-rise layer barns (Barns 1 and 2) that are owned by Ohio Fresh Eggs. The tests were conducted at the Mt. Victory facilities, to evaluate baseline and mitigated emission rates, as required by a federal consent decree. Continuous emission data was collected from September 1, 2005 to March 31, 2006. An Aluminum Sulfate (Liquid Alum and "A7", $Al_2(SO_4)_3$) and Aluminum Chloride ($AlCl_3$) spraying system was installed in Barn 2 and tested for its effectiveness in mitigating NH_3 emissions. Concentrations of NH_3 were measured at the barn exhaust fans and in ambient air using photoacoustic and chemiluminescence analyzers. Other measured variables included inside and outside temperatures, relative humidity, bird activity, building static pressure, fan operational status, and barn ventilation rate. The average outdoor temperature over the seven-month period was 5.5°C. The average daily mean untreated net NH_3 emission rates ranged from 254 to 972 g d^{-1} AU^{-1} for Barn 1 and averaged 480 g d^{-1} AU^{-1} (1.35 g d^{-1} hen^{-1}), where AU is the animal unit (500 kg live mass). The $Al_2(SO_4)_3$ and $AlCl_3$ applications reduced NH_3 emission by 23% based on the overall cross-barn comparison of paired B2-B1 NH_3 emission differences. The NH_3 mitigation efficiency of the $Al_2(SO_4)_3$ application was hindered by clogged nozzles, manure turning, and introduction of a new flock of hens into Barn 2. Higher reductions were expected and achieved (33%, 23%, and 40% reductions in Tests 5 to 7) during later test periods. The application of $AlCl_3$ was expected to further reduce NH_3 emission, but the paired B2-B1 NH_3 emission comparison averaged only 27% in Test 8. The lower NH_3 emission reduction efficiency of $AlCl_3$ was probably due to higher moisture content of manure in B2.

Introduction

Ohio Fresh Eggs, LLC owns egg production facilities located in Croton, Licking County, Ohio ("Croton Facilities"), Harpster, Wyandot County, Ohio ("Marseilles Facilities"), and LaRue, Hardin County, Ohio ("Mt. Victory Facilities"). The facilities are subject to the requirements of the Consent Decree in *United States vs. Buckeye Egg Farm, L.P., et al.*, United States District Court, Northern District of Ohio, Western Division, Civil Action No. 3:03CV7681.

The applications of Aluminum Sulfate (Alum and "A7", $Al_2(SO_4)_3$) and Aluminum Chloride ($AlCl_3$) were tested from September 1, 2005 to March 31, 2006 in Barn 2 (B2) of Ohio Fresh Egg's Mt. Victory laying facility (Site #5). The spraying system was installed and operated only in B2, while Barn 1 (B1) served as the untreated barn for comparison. An on-farm instrument shelter (OFIS) was used to house instruments to measure air emissions from the two mechanically-ventilated barns.

The test was conducted at the site of the six-month Particulate Impaction System test that ended on January 31, 2005 (Lim et al., 2005). A system for reducing particulate matter (PM) emission, which was called Electrostatic Space Charge System (ESCS), was operated from September 1, 2005 to March 4, 2006. The ESCS was also installed in B2 to mitigate PM emissions. The ESCS was initially operated for several days without $Al_2(SO_4)_3$, followed by an independent (with the ESCS off) test of Alum, and another independent test of the ESCS. By the end of September 2005, both Alum and ESCS were operated simultaneously. The tests were conducted by Dr. Teng Teeh Lim, Purdue University, and Mr. Chaoyuan Wang, Ohio State University, with supervision and oversight by Dr. Albert Heber, Purdue University.

This was the first test of applying $Al_2(SO_4)_3$ and $AlCl_3$ for NH_3 emission mitigation ever conducted in a large layer barn. The objective of the test was to determine efficacy and potential of $Al_2(SO_4)_3$ and $AlCl_3$ application in controlling NH_3 emissions of a high-rise layer barn.

Methods and Procedure

Description of Laying Barn

The two caged-hen layer barns at Mt. Victory, Ohio (20449 County Rd 245, Mt Victory, OH 43340) were built in 1994, along with 12 other barns at the facility. The barns were 201 m x 20.7 m, oriented E-W, and spaced 20.7 m apart (Figure 1). Each barn housed about 169,000 hens in eight rows of 4-tier crates in the 3.3-m high upper floor. Manure was scraped off boards under the cages into the 3.2-m high first floor. Manure drying on the first floor was enhanced with eighteen, 918-mm dia. auxiliary circulation fans (Model VG36DM3F, J&D Manufacturing, Eau Claire, WI).

The two barns were the same barns that were used to test the Particulate Impaction Curtain (Lim et al., 2005). A major difference was the locations of the manure drying fans in the manure storage pit on the first floor of the barn. The 918-mm dia. auxiliary circulation fans (Model VG36DM3F, J&D Manufacturing, Eau Claire, WI) were repositioned and rearranged to generate air patterns in a 45-degree angle with the length of the barn to minimize exposure of the fans to the sprayed Alum solution. Birds were placed in Barns 2 and 1 in July, 2004 and February, 2005, respectively; and again in B2 in December 2005

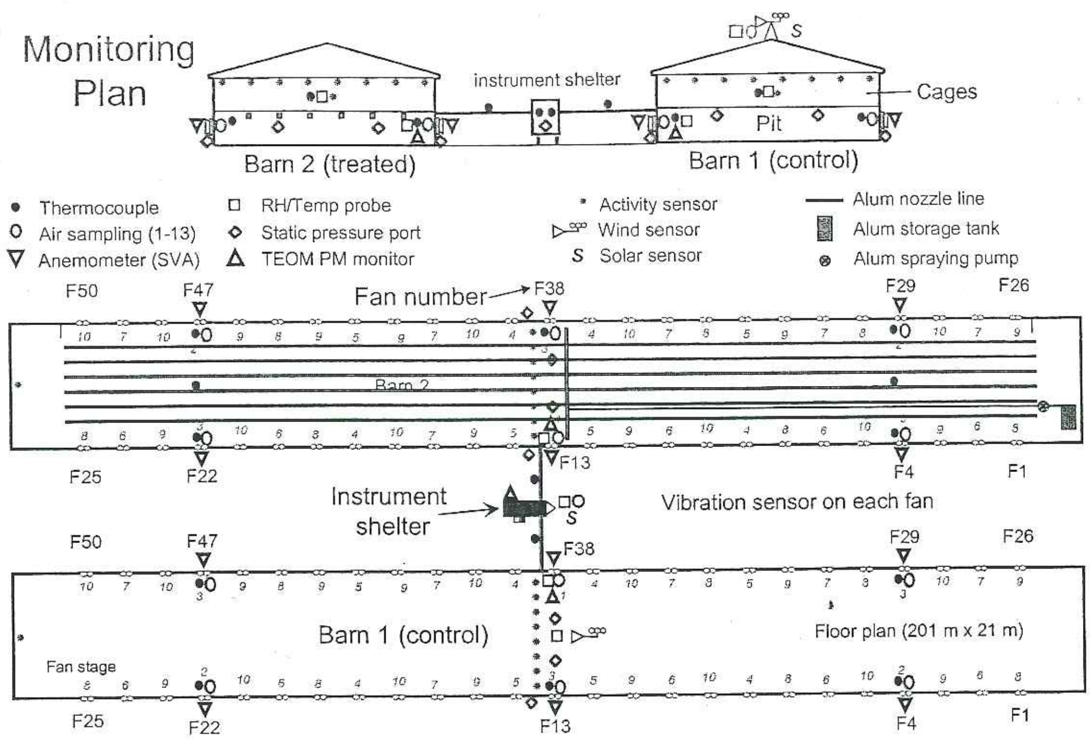

Figure 1. Layout and Cross-Section of High-Rise Layer Barns Showing Monitoring Locations.

Ventilation air was brought into the barns from the attic through temperature-adjusted baffled ceiling air inlets above the cages, and exited through continuous manure slots beneath each cage row into the pit. There were twenty-five, 1.2-m (48-in.) dia. belted exhaust fans (fans 1-25) (Advantage Fan Model AT481Z3CP, Aerotech, Lansing, MI) distributed along the east sidewall and 25 on the west sidewall (fans 26-50), Figure 1. The fans were spaced 7.3 m (24 ft.) apart and were grouped into 10 ventilation stages for this monitoring test. Each barn was originally ventilated in 26 rotating stages. The first, second and third stages consisted of 1, 2 and 3 fans each. Eggs were removed by conveyors into the egg processing plant. The cage lights were shut off for several hours each night. Egg production and water and feed consumption were also recorded automatically, while daily hen mortalities were recorded manually by the collaborating producer.

Description of the Application System

An 11.4-m^3 (3000-gal) holding tank was installed in the SE corner of the B1 pit, for storing the $Al_2(SO_4)_3$ and $AlCl_3$ solutions. Both dry (powder form) and $Al_2(SO_4)_3$ solutions were used in the first six months of the tests, while $AlCl_3$ solution was applied in the last month of the test. The spray tubes and sprinkling nozzles were installed along the length of the barn. A main tube was installed cross the middle section of the barn to deliver the solutions to each of the six lateral spraying tubes (Figure 1). The original design of the spraying system was to have eight lateral tubes installed equally distributed across the barn. However, the first and last of the spraying tubes were excluded to avoid applying the corrosive solutions onto the ventilation fans and barn sidewalls.

The $Al_2(SO_4)_3$ and $AlCl_3$ solutions were automatically sprayed for four seconds every hour, and for a total of 24 times per day. Operation of the spraying was monitored by continuously measuring and recording the pressure at the center section of the first lateral spraying tube. The pressure output signal of a liquid and gas pressure sensor (Model 230, Setra Inc., Boxborough, MA) was connected to the data acquisition system.

Experimental Design

Several tests were conducted during the seven months of testing the applications of Aluminum Sulfate (Alum) and Aluminum Chloride, September 9, 2005 to March 31, 2006. The tests were conducted in conjunction with the testing of Electrostatic Space Charge System (ESCS), which was operated from September 1, 2005, to March 4, 2006. Both the ESCS and Alum tests were conducted in B2, while B1 served as an untreated (control) barn. The test schedule and descriptions are listed in Table 1. In Test 1, the ESCS was tested independently from September 1 to 10, 2005 and again during September 21 to 29, 2005 (Test 3). In Test 2, the Alum application was tested independently from September 11 to 20, 2005. A total of six tons of dry Alum were manually sprayed onto the manure surfaces before the Liquid Alum spraying was started. The application of dry Alum was about 1.4 kg/m² of the manure surface. The Alum spraying system and ESCS have been operating simultaneously between September 29, 2005 and January 20, 2006 (Test 4).

Table 1. Tests conducted during study.

Test	Date	Description
1	9/1-9/10	ESCS
2	9/11-9/20	Alum
3	9/21-9/29	ESCS
4a	9/30-11/4	ESCS + Alum, some nozzles were clogged
4b	11/5-12/12	ESCS + Alum, nozzles were cleaned on 11/4
4c	12/22-1/20	ESCS + Alum, New hens in B2, nozzles cleaned (1/12)
5	1/21-2/9	ESCS + Alum (A7, single dose)
6	2/10-2/15	ESCS + Alum (A7, 1.5 dose)
7	2/16-3/7	Alum (A7, 1.5 dose) + evening manure scraping*
8	3/8-3/31	Aluminum Chloride + evening manure scraping

* ESCS operation was discontinued on March 4, 2006.

During Test 4, many nozzles were clogged by Alum salt accumulation, and had to be removed and washed clean. The first nozzle cleaning was conducted on November 4, 2005 when some nozzles were already clogged. Other maintenance included replacing the Alum spraying pump and flushing nozzles with water (to prevent nozzle clogging). Barn 2 was emptied of old hens on December 13, 2005, and was restocked with new birds on December 17, 2005. The original Alum was replaced with a new formula ("A7") on January 21, 2006 (Test 5). The Alum application rate was increased by increasing the spray time for Test 6. The manure scraping was changed from morning to evening for Test 7. and the A7 formula was replaced with Aluminum Chloride for Test 8.

Modification to the ESCS was made in Test 3 when the ESCS cables and electrodes were moved about 15 cm away from the Alum spraying system to avoid damage due to high voltages. The ESCS voltage was increased on September 26, 2005. In order to establish more untreated PM emission data, the ESCS was turned off on the weekend starting November 28, 2005. There were also two ESCS system failures (75% operation as 1 of 4 lines were down) for over a month. However, it was assumed that the ESCS did not significantly affect the abatement efficacy of Alum and Aluminum Chloride on ammonia (NH_3) emissions. With this assumption, the results of Tests 1 and 3 were compared with other Alum/Aluminum Chloride tests to assess NH_3 reduction.

Instrument Shelter and Raceway

An air-conditioned trailer (7.3 m x 2.3 m x 2.1 m) was located between the two barns to protect instruments and provide storage and on-site laboratory and office space for researchers. The on-farm instrument shelter (OFIS) was connected to the two barns using suspended and heated 10-cm ID PVC pipe raceways, which protected signal cables and vacuum tubes. The TEOM vacuum tubes and air sampling tubes were bundled together with heating tape and insulated. The temperatures (three points per raceway) were monitored closely for heating control to prevent condensation in the tubes.

Ammonia Concentration Measurement

Gas samples were drawn sequentially from the barn air inlet and exhaust by a gas sampling system and provided to the gas analyzers in the OFIS (Figure 1). The sequencing and duration of sampling periods were computer-controlled. The sampling period was 30 min for ambient air and 10 min for all other locations. Ambient air was sampled from the outdoor air inlet to the barn. Barn exhaust air was sampled from the lowest stages of ventilation fans. Each probe was located about 0.5 m directly in front of the fan at the same height as the fan hub.

To ascertain that a certain purge period would achieve a 90% minimum response to a step input, the response time of the systems were tested by attaching a 50-L bag of calibration gas at the end of the longest sampling tube. Since the equilibrium time was not longer than 10 minutes, the sampling period was not increased. Ambient air was sampled twice daily or every 12 hours with a sampling period of 30 minutes. A longer sampling period was used for ambient air measurement because of the time required for ammonia to desorb from tubing and other surfaces in the gas sampling system.

Ammonia concentrations were measured with a chemiluminescence (CL) NH_3 analyzer (Model 17C, TEI, Franklin, MA), after conversion to nitric oxide. The analyzer sampled air at a flow rate of 0.6 L/min with an external vacuum pump (Model PU426, KNF Neuberger, Trenton, NJ). A photo-acoustic infrared (PIR) NH_3 monitor (Mine Safety Appliances, Pittsburgh, PA) was collocated with the CL method for the barn measurements. The measurement ranges of PIR analyzers could be set at either 0-100 or 0-1000 ppm. The PIR NH_3 monitor was set at 0-1000 ppm prior to August 20, 2004 and at 0-100 ppm for the rest of the test. Each NH_3 analyzer was checked or calibrated with standard zero and span gases at least twice per week.

Pressure Measurement

Differential pressures across each building sidewall as fan operating pressures were monitored continuously using differential pressure transmitters (Model 2671-100-LB11-9KFN, Setra, Boxborough, MA). The measurement range of the transmitter was ±100 Pa, with an accuracy of ±1%. The purpose of differential pressure measurements was to monitor operation of the ventilation system, and to aid in the calculation of fan airflow using fan performance curves. The pressure sensor was shunted for calibration checking and compared with an inclined manometer at various span pressures. Atmospheric pressures were monitored with barometric pressure transducers in the TEOMs

Ventilation and Environmental Variables

The operating status (on/off) of each fan stage was monitored via auxiliary contacts of fan motor control relays, backed up with either an open impeller anemometer or a vibration sensor (Ni et al., 2005) installed at each individual fan. Fan airflow capacities were measured on October 5 and 6, 2005, with a calibrated portable fan tester that consisted of multiple traversing impeller anemometers (Gates et al., 2004). During these tests, the building static pressure was recorded and the airflow was compared with the ventilation rates estimated from independent tests conducted for the fan model and published by the manufacturer. The actual fan airflow was estimated from static pressure using a fourth-order polynomial equation that was developed for each ventilation fan, based on the field test data.

The temperature and humidity of exhaust air, along with barometric pressure, were needed for volume correction to standard conditions. Copper-constantan thermocouples (Type T) were used to sense temperatures throughout the barns and in the OFIS at various locations: 1) exhaust sampling points, 2) heated raceways, and 3) trailer and instrumentation. The sensors were calibrated prior to and following the test using a constant-temperature bath.

A relative humidity (RH) and temperature (T) probe (Model HMW61, Vaisala, Woburn, MA) was collocated with each TEOM (Figure 1). Another RH/T probe (Vaisala Model Humitter 50Y) was located in an emptied cage at the center of each barn. A solar-radiation-shielded RH/T probe (Vaisala Model HMD60YO), a cup anemometer, and wind direction vane were attached to the top of the barn.

Hen activity was monitored using passive infrared motion detectors (Model SRN-2000N, ADI Inc., Bridgeview, IL) that generated voltages proportional to movement. The detectors were mounted on the ceiling above each row of cages in both barns and tilted slightly downward to face the cages.

Manure sampling and Analysis

Manure from the layer barns was sampled monthly to determine moisture content and pH values, which are important factors affecting PM and NH_3 emissions. Thirty-six (36) surface samples were collected from randomly selected locations in each barn. After collection, the samples were put on ice and delivered to the Purdue Manure Analysis Laboratory for analysis of moisture content and pH.

Data Acquisition and Processing

A custom PC-based data acquisition and control (DAC) program was developed using LabVIEW for Windows (National Instruments Co., Austin, TX). The program communicated with DAC hardware, which included several external DAC modules and an internal card (FieldPoint and PCI 6601 DIO, National Instruments Co., Austin, TX, respectively). A separate internal DAQ card coupled with an external expansion board (PCIM-DAS1602/16 and EXP32, respectively, Measurement Computing Corporation, Middleboro, MA) provided 32 more analog input channels. Four digital input modules (Measurement Computing Corporation MiniLab™ 1008 Personal Measurement Devices) acquired digital input signals from the vibration sensors. Data acquired by the DAQ system were sampled at a frequency of 1 Hz, then averaged every 15 s and 60 s, and recorded.

A custom data processing program, CAPECAB (Calculation of Aerial Pollutant Emissions from Confined Animal Buildings), was used to process the 60-s data set (Eisentraut et al., 2004a; 2004b). PM concentrations were converted to concentrations at standard temperature and pressure (STP, 1 atm and 20°C) for calculating emissions. Average daily means (ADM) were calculated using only days with over 70% valid data (complete-data days). ADM for both barns were calculated as weighted means.

For emission rate calculation, the inlet mass flow rate was subtracted from the outlet emission to obtain the net emission rate. The barn emission rate is the sum of several emission streams represented by multiple sampling locations corresponding to multiple ventilation exhausts. The calculation of net emission rate with multiple ventilation exhaust sampling locations is:

$$E = \sum_{k=1}^{n}\left[Q_{o,k}\left(C_{o,k} - C_i\right)\right] \qquad (1)$$

where:

E Gas emission rate from the barn (mg/s)

$C_{o,k}$ Mass concentration at ventilation exhaust location k (mg/m^3 or µg/m^3)

C_i Mass concentration in incoming ventilation air (mg/m^3 or µg/m^3)

$Q_{o,k}$ Ventilation rate at ventilation exhaust location k (m^3/s)

Results

This report includes analysis of data collected from September 1, 2005 to March 31, 2006. All of the reported average daily mean (ADM) or hourly mean values consisted of over 70% valid data (complete-data days or complete-data hours) to avoid biasness due to missing data. The data completeness values for barn NH_3 emission, in terms of the number of days with over 70% valid data, were 83% and 79% for B1 and B2, respectively. The fewer complete-data days for B2 emission rate was partially due to the changing of hen flocks, which was about 5% (11 days) of the 212 measurement days.

The NH_3 concentration measurement was conducted using both photoacoustic and chemiluminescence analyzers. However, the emission data reported in this report are calculated based on the chemiluminescence analyzer. Based on the 367 available paired daily barn exhaust concentrations of both analyzers, the mean concentrations were 54.7 and 54.3 ppm for the photoacoustic and chemiluminescence analyzers. Thus the difference between the two analyzers measurement was minimal.

The basic statistics of important variables, including barn inventory, environment variables, and ADM emission values are reported in Tables 2 and 3. The monitoring test started with 158,787 and 153,660 hens, and ended with 154,091 and 157,766 hens in B1 and B2, respectively (Figure 2). A new flock of hens was introduced into B2 in mid-December 2005; thus the beginning and ending bird numbers were not the maximum and minimum values. The flocks of W36 hens in B1 and B2 were 46 and 73 weeks old when the monitoring test started, and were 76 and 33 weeks old when the test ended. The ADM bird mass was 1.40 and 1.53 kg for B1 and B2, respectively. The ADM total live mass of B1 and B2 were 441 and 468 AU (AU=500 kg live mass), respectively. B2 started with a new flock of hens which was still growing, and was gaining weight faster when newly introduced into B2 (Figure 2).

Table 2. Summary of Daily Means at Barn 1. 9/1/2005 to 3/31/2006.

Parameter	n	Min	Mean	Max	SD
Bird inventory, n	212	154,091	156,571	158,787	1419
Mean bird mass, kg/bird	212	1.37	1.41	1.45	0.02
Total live mass, AU	212	427	441	457	6.3
Temperatures, °C					
Ambient air	201	-13.1	5.52	21.7	8.39
Cages	197	20.3	23.0	26.8	1.43
Exhaust air	197	13.8	20.2	26.4	2.91
Airflow, dsm³/s	191	29.1	78.2	257	56.6
Ammonia Concentration and Emission Rate					
Ambient conc., ppm	198	0.00	2.35	9.59	1.64
Exhaust conc., ppm	196	12.05	60.34	108	23.8
Net emission, mg/s	175	1,312	2445	4,997	622
Net emission, kg/d	175	113.4	211.2	432	53.7
Net emission, g d^{-1} AU^{-1}	175	254	480	972	122
Net emission, g d^{-1} hen^{-1}	175	0.71	1.35	2.79	0.35

Table 3. Summary of Daily Means at Barn 2. 9/1/2005 to 3/31/2006.

Parameter	n	Min	Mean	Max	SD
Bird inventory, n	204	148,197	154,222	158,120	3302
Mean bird mass, kg/bird	207	1.12	1.52	1.66	0.10
Total live mass, AU	204	354	468	495	24.6
Temperatures, °C					
Ambient air	201	-13.1	5.5	21.7	8.39
Cages	189	15.5	21.7	27.1	2.86
Exhaust air	181	9.79	19.4	26.3	3.72
Airflow, dsm³/s	179	31.1	83.1	287	63.2
Ammonia Concentration and Emission Rate					
Ambient conc., ppm	198	0.00	2.35	9.59	1.64
Exhaust conc., ppm	187	8.20	48.9	105.4	21.2
Net emission, mg/s	168	636	1986	3,454	487
Net emission, kg/d	168	55.0	172	298	42.1
Net emission, g d^{-1} AU^{-1}	162	113	369	687	100
Net emission, g d^{-1} hen^{-1}	168	0.36	1.11	1.90	0.27

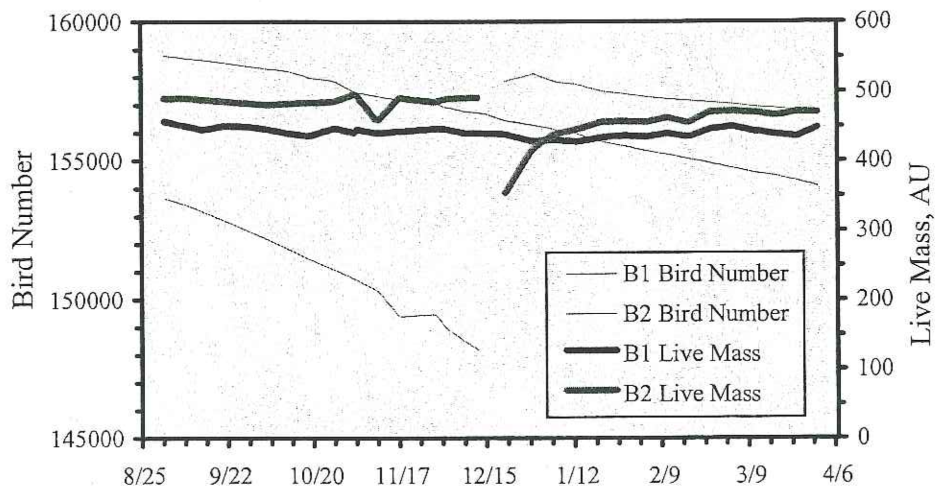

Figure 2. Bird number and total live mass.

The ADM airflow rates of B1 and B2 were 78.2 and 83.1 dsm³/s, respectively. As expected, barn ventilation rates were generally higher in warm weather (Figure 3). Daily mean airflow rate ranged from 29 to 257 dsm³/s for B1, and ranged from 31 to 287 dsm³/s for B2. The ADM ambient temperature was 5.65°C (ranged from -13.1°C to 21.7°C), while the historical mean annual local temperature is 10.0°C. The ADM ambient temperature was 5°C lower than the local mean annual temperature, thus this data set represents cooler than average weather. Similar polynomial equations relating airflow rate and ambient temperature were developed for each barn, suggesting that the two barns had similar ventilation rate and temperature control (Figure 4). Close correlation between the ambient temperature and barn airflow rate was also found in a previous study (Lim et al., 2005). A paired t-test was conducted to examine the barn ventilation rates, and indicated that the two were not significantly different (P=0.002).

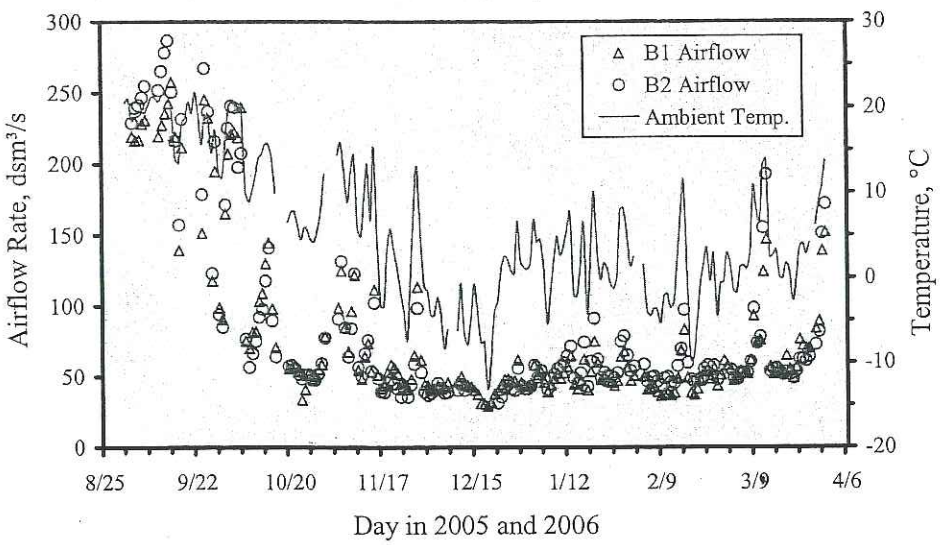

Figure 3. Barn ventilation rate and ambient temperature.

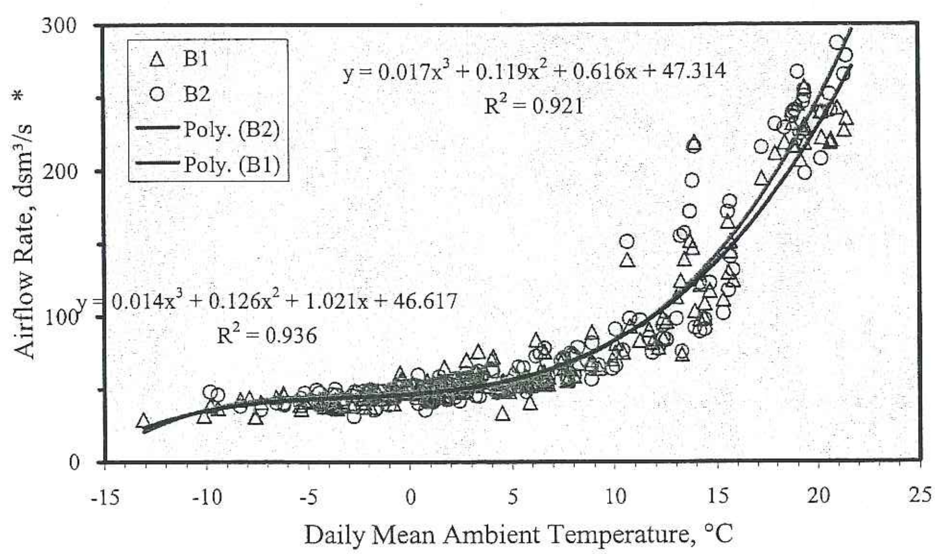

Figure 4. Influence of ambient temperature on barn ventilation rate.

The daily mean barn (cage level) and pit exhaust temperatures are presented in Figure 6. The ADM cage temperatures (centers of cages) were 23.0°C and 21.7°C for B1 and B2, respectively, and were not statistically different based on a paired t-test ($P<0.001$). However, the temperatures of B2 were maintained generally higher at the beginning of the test, and became generally lower than B1 starting in December with the new flock of hens (Figure 5). The ADM exhaust temperatures (up to six sampling locations) were 20.2°C and 19.4°C for B1 and B2, respectively. Only two thermocouples of the six installed were used to measure B2 exhaust temperatures, because the other four detected static noises from the high voltage operation of the ESCS, and were thus disconnected.

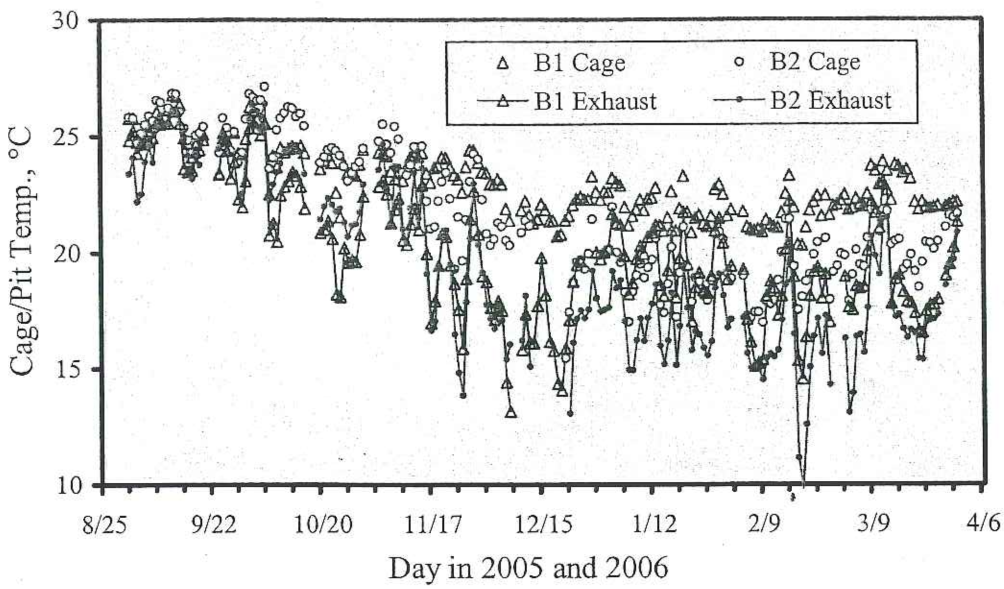

Figure 5. Daily mean cage and pit exhaust temperatures

The ADM fan differential pressures (averages of the west and east sidewall sensors) were -24.7 and -11.9 Pa for B1 and B2, respectively (Figure 6). The daily mean fan pressures ranged from -5.4 to -32.6 Pa, and -2.5 to -16.8 Pa for B1 and B2, respectively. It is not known why did the two barns had such difference in the fan differential pressure, even though they had similar barn temperatures and ventilation rates. The inconsistent B1 pressures in the months of September and October 2005 indicated pressure was not well maintained, suggested that the ventilation inlet openings were not controlled according to barn static pressure to provide optimum ventilation fan operation.

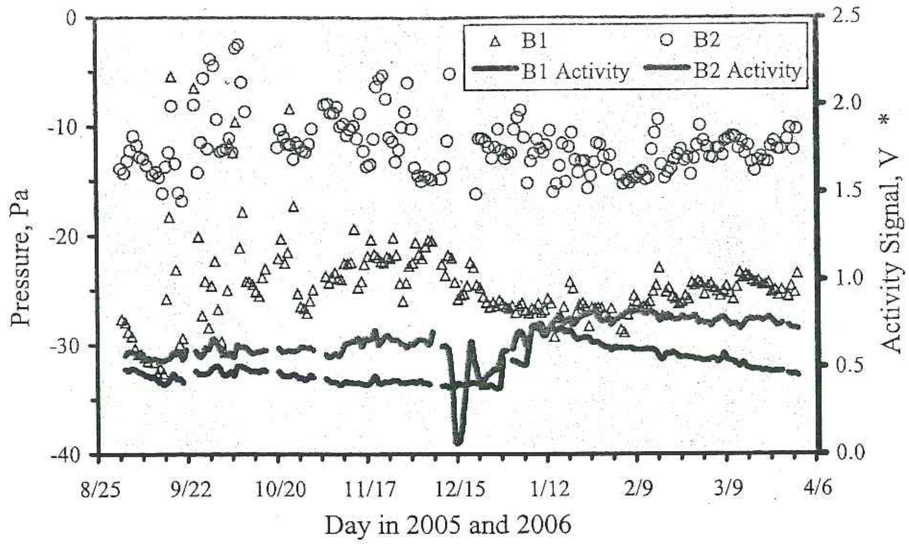

Figure 6. Daily mean barn static pressure and hen 'activity.

The ADM hen activity signal of B1 was 0.50 mV, and was 0.64 mV for B2 (Figure 6). The mean B2 activity signal declined to about zero in mid-December 2005 because the spent hens were removed. The B2 activity increased gradually after the barn was stocked full and the light schedule was lengthened. The barn lighted hours were usually kept shorter for the younger hens. The small peak of activity around December 20, 2005 was due to an extended period of the lighted schedule in B2. The lights of B2 were accidentally kept on for December 20 and 21; thus the higher hen activity signals were detected. The hen activity of B1 was generally lower than B2. However, since the performance of activity sensor was affected by factors such as light intensity, detection angle, and cleanliness of the sensor cover, and because the sensors could not be calibrated for uniform performance, the signals were used only for reletive comparisons within each barn.

Daily mean exhaust air relative humidity (RH) ranged from 47% to 83%, and 42% to 72% for B1 and B2, respectively, while the ambient RH ranged from 44% to 96% (Figure 8). The ADM RH was 76% for ambient air, and 67% and 57% for B1 and B2, respectively. The exhaust RH of B2 appeared to be consistently lower than that of B1. The ADM cage RH of B1 was 53%, and was 54% for B2.

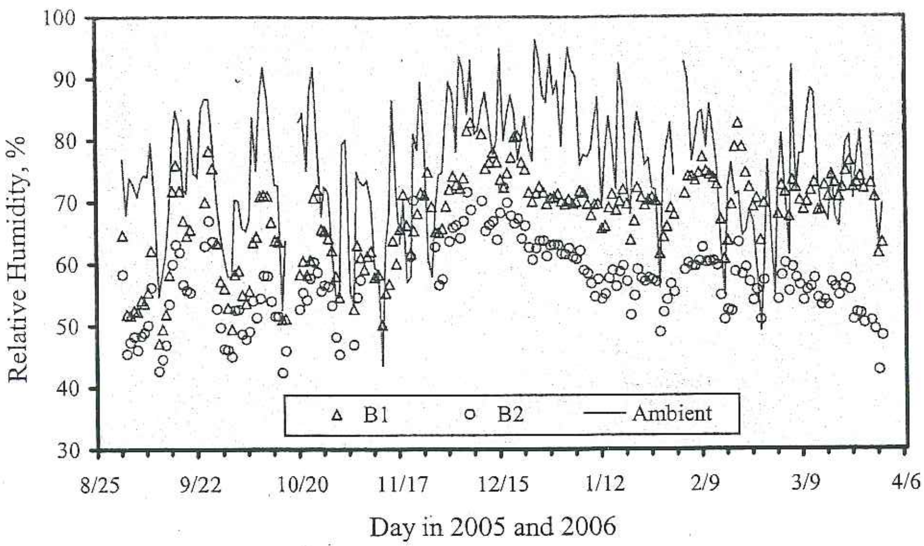

Figure 7. Daily mean barn exhaust and ambient RH.

Results of Ammonia Measurement

The ADM ambient NH_3 concentration was 2.35 ppm (n=198 out of 212 days) and remained relatively stable throughout the entire measurement period (Figure 8). The ambient NH_3 concentration ranged from 0.0 to 9.6 ppm, and was relatively higher in warm weather, most probably due to the larger amount of exhaust air from the surrounding barns. The ADM exhaust concentrations and emission rates of both barns are also shown in Figure 8. Data collected when only the ESCS system was operating, before Alum application was applied (Test 1, September 1 to 10) was used as the control period, to compare the concentrations and emission rates between the two barns. Both the concentration and emission values of the two barns prior to Alum spraying appeared to be very similar. The paired concentration and emission rate differences were -3.7% (B1 was lower, n=8) and 11% (B1 was higher, n=4), respectively (Table 4).

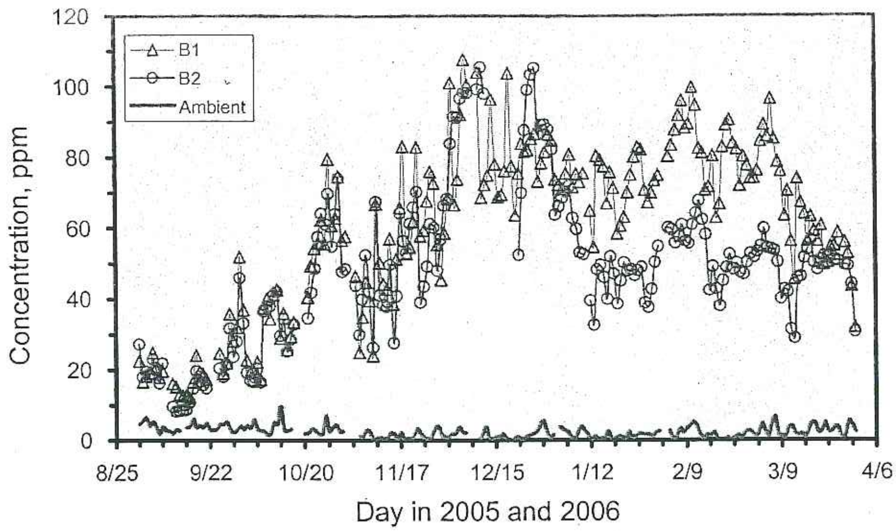

Figure 8. Daily mean NH_3 concentrations of Barns 1 and 2, and ambient air.

Table 4. Mean NH_3 concentration and emission rate of individual tests, and difference between the two barns.

Test	Date	NH_3 concentration, ppm			NH_3 emission, g d^{-1} AU^{-1}		
		B1	B2	Diff, %	B1	B2	Diff*, %
1	9/1-9/10	19.9	20.7	-3.7%	403	365	11%
2	9/11-9/20	16.1	12.1	26%	321	213	29%
3	9/21-9/29	24.5	21.7	11%	455	366	12%
4a	9/30-11/4	42.8	40.4	5.9%	402	333	16%
4b	11/5-12/12	62.7	60.5	1.2%	450	366	16%
4c	12/22-1/20	75.7	66.0	14%	516	461	17%
5	1/21-2/9	77.5	50.5	35%	524	349	33%
6	2/10-2/15	86.3	61.4	28%	499	384	23%
7	2/16-3/7	80.2	49.8	38%	565	342	40%
8	3/8-3/31	58.5	46.5	19%	583	415	27%

* Calculated based on paired B2-B1 emission rate comparison.

Figure 9 shows the daily mean NH_3 emission rates. The daily mean NH_3 emission rates ranged from 254 to 972 g d^{-1} AU^{-1} for B1, and ranged from 113 to 687 g d^{-1} AU^{-1} for B2 (including treated and untreated data). The ADM untreated NH_3 emission rates of B1 was 480 g $d^{-1}AU^{-1}$ (1.35 mg d^{-1} hen^{-1}). In the previous test with the same barn, the ADM untreated NH_3 emission rates of B1 was 352 g d^{-1} AU^{-1} (unpublished data); the higher values were most probably due to the higher NH_3 concentrations during the colder weather. These values were higher than a six-month summer to winter NH_3 emission of 92.8 g d^{-1} AU^{-1} for a new layer barn with manure belt (Sun et al., 2003).

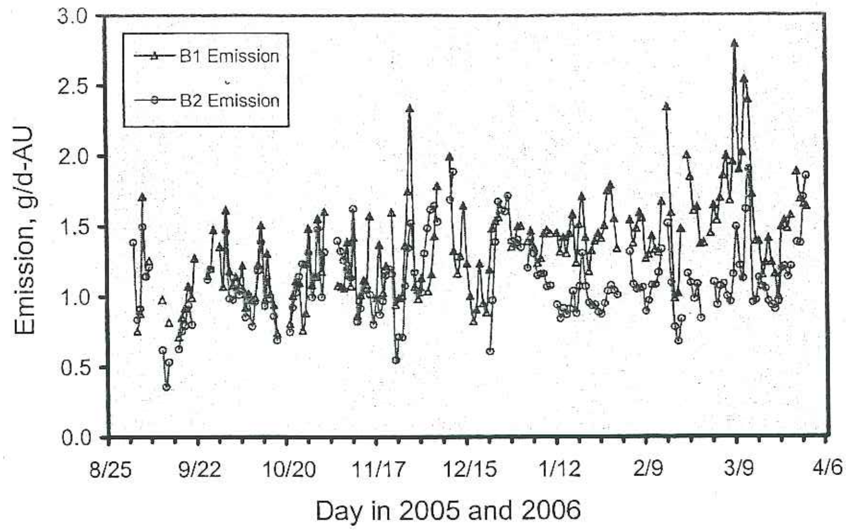

Figure 9. Daily mean NH_3 emissions of Barns 1 and 2.

<u>NH_3 Emission Reductions using the Aluminum Sulfate and Chloride Application</u>

The ADM NH_3 emission rates were 403 and 365 g d^{-1} AU^{-1} for B1 and B2, respectively, before the Alum spraying was started, while they were 483 g d^{-1} AU^{-1} for B1 (control) and 369 g d^{-1} AU^{-1} for B2, for all the Alum tests (Tests 2 and 4 to 8). The emission values of Test 3 were not included in the comparison because the remaining Alum from Test 2 was expected to continue treating the manure even though the $Al_2(SO_4)_3$ application was discontinued. The overall paired emission differences between the two barns were 11% and 23% for the control (Test 1) and treated tests (Tests 2 and 4 to 8), respectively.

Since the B2 NH_3 emission rate of Test 1 was 11% (mean of 4 paired emission rate differences) lower than B1, the overall reduction of 23% due to $Al_2(SO_4)_3$ and $AlCl_3$ applications may be slightly lower. However, the 11% difference in Test 1 was calculated from a small number of paired emission values, and Test 1 lasted only 10 days in September, which is a very small portion of the seven-month test, thus the barn difference before the treatment was not used to correct or adjust the reductions in the following tests.

The mean NH_3 emission rates of Test 2, when the dry and $Al_2(SO_4)_3$ solution was first applied, were 321 and 213 g d^{-1} AU^{-1} for B1 and B2, respectively. It is apparent that the B2 NH_3 emission rate was reduced by the $Al_2(SO_4)_3$ application, the mean paired B2-B1 emission reduction was 29% (n=7 out of 10 d). In Test 4, the ADM NH_3 emission rates were 447 and 379 g d^{-1} AU^{-1} for B1 and B2, and the mean paired difference was 16% (n=31 d, September 30, 2005 to January 20, 2006).

The lower NH_3 emission reduction by $Al_2(SO_4)_3$ solution only application in Test 4 was probably due to the following problems:

1) many nozzles were clogged (Figure 10);
2) more frequent manure turning activities in both barns; and
3) the lack of a layer of Alum powder as compared with Test 2.

The clogged nozzles reduced the Alum application rate and the total area of $Al_2(SO_4)_3$-treated manure surfaces, thus lowering the emission reduction. The more frequent manure turning may have destroyed the protective layer of $Al_2(SO_4)_3$. The $Al_2(SO_4)_3$ product was not designed to be mixed into the manure pile to react with manure and reduce NH_3 emission. This is especially true when a significant part of the NH_3 emission was expected to be generated by the newly scraped, fresh manure on the surfaces of the piles. The lower reduction at the end of December (Test 4c) was probably caused by the new flock of hens in B2, in addition to the many clogged nozzles. After the flock adapted to the new environment, and more than 40 nozzles were removed and cleaned, the paired NH_3 emission differences averaged 35% (n=8) for January 13 to 20, 2006.

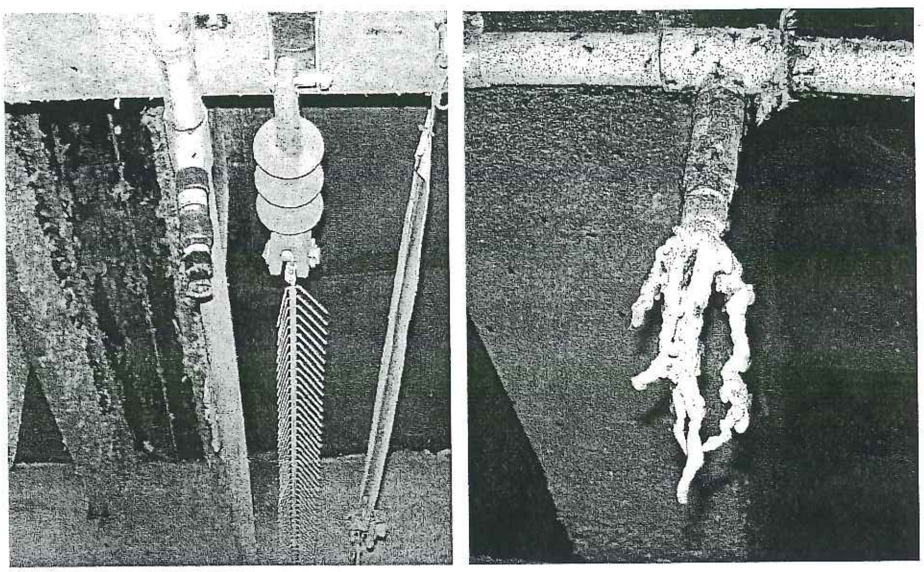

Figure 10. A newly installed nozzle and lateral tube next to the ESCS system (left, picture was taken on September 8), and a clogged nozzle (right, picture was taken on November 1).

The mean paired emission differences between the two barns were 33%, 23%, 40%, and 27% for Tests 5 to 8, respectively (Table 2). The highest paired NH_3 emission reductions were found in the Tests 5 and 7, which were probably due to the combination effects of the well-functioning nozzles, evening manure scraping, and application of A7 $Al_2(SO_4)_3$. Due to the lack of test replication and only one treated barn, it is not known which factor contributed the most. The emission rate differences between the two barns averaged 32%, and ranged from -10% to 52% between January 21 and March 31.

The ADM NH_3 emission rates were 583 and 415 g d^{-1} AU^{-1} for B1 and B2 in the test of $AlCl_3$ (Test 8). The abatement effect of $AlCl_3$ appeared to be lower than the Alum, but the lower reductions were probably caused by the higher manure moisture content in B2. Manure in B2 was found to be wetter at the end of the tests, most likely due to the amount of moisture from increased spraying rate and additional flushing water from cleaning the spraying system. Manure with higher moisture content was expected to release more NH_3 than drier manure piles. The other important factor was the lower barn ventilation rate in the colder months. The ADM barn airflow rates were 242, 57, and 81

m^3/s during Tests 2, 7 and 8, respectively. Since barn airflow was over 70% lower in the colder months, the extra moisture applied onto the manure surfaces was probably not removed as efficiently in the warmer months. Manure moisture content and pH values are reported in Table 5. Some manure sample data is not yet analyzed.

Table 5. Mean Manure Dry Matter Content and pH.

	Barn 1					
	Moisture content, %			**pH**		
Date	**Mean**	**n**	**S.D.**	**Mean**	**n**	**S.D.**
8/19/05	28.9	24	13.7	8.6	24	0.3
10/28/05	23.5	24	15.2	8.8	24	0.4
11/22/05	27.4	24	7.7	9.0	24	0.1
Overall	26.6			8.8		
	Barn 2					
	Dry Matter, %			**pH**		
Date	**Mean**	**n**	**S.D.**	**Mean**	**n'**	**S.D.**
8/19/05	26.7	24	10.0	8.7	24	0.2
10/28/05	27.3	24	16.5	8.4	24	0.3
11/22/05	25.7	24	7.0	8.5	24	0.3
Overall	26.6			8.5		

Conclusions

1. The overall paired emission differences between the two barns were 11% and 23% for the control (Test 1) and treated tests (Test 2 and Tests 4 to 8), respectively.
2. The $Al_2(SO_4)_3$ application reduced NH_3 emission rate by 29% when Alum was first applied from September 11 to 20.
3. The NH_3 emission reduction was lower than 16% between September 30, 2005 and January 20, 2006, most probably due to clogged nozzles, manure turning, and introduction of new flock of hen in B2.
4. The efficacy of the Alum spraying was the highest from January 21 to March 7, 2006, when the nozzles were well maintained, manure turning was discontinued, application rate was increased, and daily manure scraping was switched from morning to evening. The paired emission rate differences between the two barns averaged 32%, and ranged from -10% to 52% for this period.
5. The application of $AlCl_3$ achieved lower reductions in NH_3 concentration and emission rate than the previous three tests, and the difference in B1 and B2 NH_3 emission rate was 27%. It is most likely that the higher moisture content of manure in B2 hindered the efficacy of $AlCl_3$.

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CHICAGO, IL 60604-3590

REPLY TO THE ATTENTION OF

VIA ELECTRONIC AND U.S. MAIL

August 3, 2006

Mr. Brian M. Babb, Esq.
Keating, Muething & Klekamp, P.L.L.
1400 Provident Tower
One East Fourth Street
Cincinnati, OH 45202
bbabb@kmklaw.com

RE: Review of Ohio Fresh Eggs, LLC's May 31, 2006 Final Report of the Test of Electrostatic Space Change System for Ohio Fresh Eggs' Mt. Victory Facility Under Attachment A of Consent Decree (U.S. v. Buckeye Egg Farm, L.P., et al. - Civil Action No. 3:03 CV 7681)

Dear Brian:

This letter acknowledges the U.S. Environmental Protection Agency's (EPA's) receipt of Ohio Fresh Eggs, LLC's (OFE's) May 31, 2006 Final Report of the Test of Electrostatic Space Charging System (the "Final PM Report"). EPA has reviewed this report and approves OFE's PM control plan to use the Electrostatic Charging System (ESCS) as the PM control technology at the Marseilles, Mt. Victory and Croton facilities.

OFE submitted its Final PM Report on the ESCS as required by Section I, paragraph 17 of Attachment A to the Consent Decree. While OFE's Final PM Report provides the mean period emission rate for Barns 1 and 2 for the measurement period, it does not extrapolate that data to determine the annual emissions rate. Paragraph 17 of Attachment A to the Consent Decree requires OFE to submit its conclusions regarding the annual emission rate. Accordingly, OFE is required to submit this calculation to EPA within fourteen days of receipt of this letter as an addendum to the Final PM Report. These calculations must be conducted in accordance with Exhibit 3 to the Consent Decree. Exhibit 3 requires an evaluation of the temperature-weighted emission rate followed by total annual emissions based on historical temperature data.

OFE shall install the ESCS at the Marseilles, Mt. Victory and Croton facilities in accordance with Section C (Implementation) of Attachment A to the Consent Decree. The specific conditions of implementation will be based on EPA's final review of the annual emissions as calculated above, and are summarized below.

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION 5
77 WEST JACKSON BOULEVARD
CHICAGO, IL 60604-3590

REPLY TO THE ATTENTION OF:

VIA ELECTRONIC AND EXPRESS MAIL

April 21, 2005

Mr. Brian M. Babb, Esq.
Keating, Muething & Klekamp, P.L.L.
1400 Provident Tower
One East Fourth Street
Cincinnati, OH 45202
bbabb@kmklaw.com

RE: Stipulated Penalties Demand, U.S. v. Buckeye Egg Farm, L.P., et al.
Civil Action No. 3:03 CV 7681

Dear Mr. Babb:

Over the past nine months, the United States Environmental Protection Agency (EPA) has worked diligently with Ohio Fresh Eggs, LLC (OFE) to remedy OFE's repeated failures to comply with the requirements of the above-captioned Consent Decree. Those repeated efforts have been unavailing, as OFE remains in substantial noncompliance with the Consent Decree. At this juncture, EPA, in consultation with the United States Department of Justice, has determined that OFE's failure to comply is so egregious that stipulated penalties as provided under the Consent Decree must be assessed. This letter summarizes some of OFE's most flagrant violations of the Consent Decree to date. Please note that OFE continues to violate the Consent Decree and stipulated penalties shall continue to accrue until such time as OFE complies with the Consent Decree.

Attachments 1, 2 and 3 present, in table summary, a timeline of requirements applicable to OFE's Croton, Marseilles and Mt. Victory facilities, as follows: Attachment 1 sets forth certain requirements pertaining to the particulate matter control plan at the Croton facility; Attachment 2 sets forth certain requirements pertaining to the particulate matter control plan at the Marseilles facility and Mt. Victory facility; and Attachment 3 sets forth certain requirements pertaining to the ammonia control plan at the Marseilles facility and Mt. Victory facility.

Attachment 4 itemizes each element of our stipulated penalty demand by requirement and related dollar amount. With respect to Attachment 4, please note that EPA has only calculated a stipulated penalty total through March 31, 2005. EPA reserves the right to seek stipulated penalties for the additional days of violation that have occurred after March 31, 2005, if OFE continues to fail to comply with the requirements of the Consent Decree. Please be advised that EPA has calculated stipulated penalties using a conservative approach (i.e., an approach more favorable to OFE than we could otherwise use). If OFE continues to fail to comply with the requirements of the Consent Decree, EPA reserves its right to recalculate the stipulated penalties using other dates and formulas.

Briefly, OFE's most glaring violations include the following: the failure to timely and appropriately conduct any of the testing required by the Consent Decree at the Croton facility, except for the required Method 5/17 testing; the failure to submit and implement in a timely manner an acceptable plan to reduce ammonia emissions from the Marseilles and Mt. Victory facilities; and the failure to comply with the testing protocol OFE submitted to reduce ammonia emissions at the Marseilles and Mt. Victory facilities.

In reviewing OFE's compliance with the Consent Decree, it is useful to review the terms of the Consent Decree. As OFE is aware, the Consent Decree required OFE to commence no later than August 2004 the required six continuous months of approved particulate matter testing, also referred to as secondary method testing, or Silsoe testing, and ammonia controls testing at OFE's Marseilles or Mt. Victory facility; and to commence no later than August 2004 the required six continuous months of approved particulate matter testing at the Croton facility. (See, for example, Paragraph I.B.16 of Attachment A to the Consent Decree which requires OFE to commence six continuous months of particulate matter testing emission testing at the Croton facility, and to ensure that such testing includes the month of August 2004; see a similar provision for the Marseilles or Mt. Victory facility at Paragraph I.B.11. of Attachment A to the Consent Decree; see also Paragraph I.B.29 of Attachment A to the Consent Decree which requires OFE to implement an approved Ammonia Plan to reduce ammonia emissions and to commence continuous testing for six months, including the month of August 2004; see also the first paragraph of EPA's May 3, 2004 letter allowing for extensions of time to commence testing "as long as other subsequent deadlines will not be affected, and, in particular, the six months of continuous testing will still include the month of August 2004 as required by the Consent Decree.")

One of the primary reasons that the Consent Decree required testing to include the month of August 2004 in the six continuous months of particulate matter testing at the Croton facility and the six months of continuous particulate matter and ammonia emission testing at the Marseilles or Mt. Victory facilities is the potential health risks to the surrounding community stemming from OFE's elevated emission levels of ammonia and particulate matter. August is the month during which ambient levels of these contaminants typically peak in the surrounding community. OFE's failure to test and control these emissions as contemplated by the Consent Decree means that the people who live near OFE's Croton, Marseilles and Mt. Victory facilities will continue to be subject to these uncontrolled ammonia and particulate matter emissions.

With respect to required particulate matter testing at its Croton facility, shortly before one of the first requirements of the Consent Decree became due, on May 3, 2004, OFE indicated that its failure to perform required Method 17 particulate matter testing for one month at the Croton facility was due to a force majeure event. By letter dated June 7, 2004, EPA advised OFE that it did not accept OFE's claim of force majeure.

Ammonia testing is another Consent Decree requirement that OFE has failed to meet. During a June 8, 2004 call with you and OFE's expert, Dr. Albert Heber, EPA learned that bench scale testing of Eco-Cure™, which OFE proposed to use to reduce ammonia emissions, indicated that this product had no effect on reducing ammonia emissions. We discussed alternatives to Eco-Cure™, including the use of aluminum sulfate and dietary modification to control emissions. Our concerns about the ineffectiveness of Eco-Cure™ were reiterated in EPA's June 14, 2004 letter. Yet, in a July 27, 2004 letter, OFE requested that EPA approve Silsoe testing of Eco-Cure™ asserting that the bench-scale test was not representative because, in part, not enough of the product was applied, even though the initial application rates were five times higher than recommended by the manufacturer. OFE submitted this request to EPA just four days before August 1, 2004, the month that OFE was required by the Consent Decree to include in its six month test. Then, OFE submitted its Revised Ammonia Emissions Control Design and Implementation Plan, dated August 2004, again proposing to use Eco-Cure™ as its control strategy. It was not until September 24, 2004, that OFE submitted a revised ammonia plan for Silsoe testing of a feed additive that, unlike Eco-Cure™, was based on a sound scientific theory and test data indicating the potential for significant reductions in ammonia emissions. OFE's deliberate and repeated submission of an ineffective ammonia control product already disapproved by EPA constitutes a failure to comply with the Consent Decree. To further compound matters, OFE apparently stopped using the approved feed additive after one and a half months and therefore failed to complete six months of testing.

As OFE continued to submit requests for extensions, by letter dated August 13, 2004, EPA finally advised OFE that no further extensions to requirements under the Consent Decree would be granted, and that EPA was holding in abeyance stipulated penalties that otherwise could have been assessed for failure to timely submit the Method 17 stack test report ". . .as long as all other future deadlines are met. If any future deadlines are missed, EPA reserves the right to request all stipulated penalties associated with this required report."

On October 12, 2004, OFE notified EPA that it was out of compliance with the Consent Decree. On April 5, 2005, in response to a Clean Air Act Section 114 request for information, OFE advised EPA that it had stopped performing the Silsoe testing at its Mt. Victory facility on February 1, 2005.

As OFE has made little effort to comply with the requirements of the Consent Decree, EPA has determined that it is appropriate to seek stipulated penalties in the amount of $533,300. (See Attachment 4.)

Pursuant to paragraphs 43 and 47 of the Consent Decree, payment must be made within thirty (30) days of receipt of this letter using the EFT instructions previously provided by the Financial

Litigation Unit of the U.S. Attorney's Office for the Northern District of Ohio, Western Division. Please see paragraph 35 of the Consent Decree for specific payment information.

In addition to reserving all rights to (1) seek penalties for violations that continue and/or occur after March 31, 2005, and (2) recalculate our stipulated penalty demand for violations that occurred prior to March 31, 2005, as stated above, EPA is also continuing to review OFE's compliance with other requirements of the Consent Decree, and reserves all rights to seek additional stipulated penalties for any other violations of the Consent Decree that may be uncovered.

Please call me if you have any questions at (312) 886-6237.

Sincerely,

Mary T. McAuliffe

Mary T. McAuliffe
Associate Regional Counsel

Enclosures

Attachment 1 - OFE Timeline/Chronology (Croton Facility - PM Control Plan)
Attachment 2 - OFE Timeline/Chronology (Marseilles/Mt. Victory - PM Control Plan)
Attachment 3 - OFE Timeline/Chronology (Marseilles/Mt. Victory - NH3 Control Plan)
Attachment 4 - Stipulated Penalty Worksheet

ATTACHMENT 1

OFE Timeline/Chronology For Consent Decree Requirements
Croton Facility - PM Control Plan

CD-Requirement	Date Due	Date Submitted/ Completed	Extension(s) Given	Extension Due Date	Comments
Submit PM control plan for bird variety /higher fat-oil feed change	March 15, 2004	March 15, 2004	No	N/A	OFE submission letter dated May 17, 2004 cites "EPA's April 19, 2004 comment letter on the proposed PM and Ammonia Control Plans".
Complete preliminary M5/17 testing of bird variety/higher fat-oil feed change	May 15, 2004	June 11, 2004	Yes	June 15, 2004	OFE submitted extension request in letter dated May 3, 2004 asking for extension until June 15, 2004. EPA approves extension request in letter dated May 3, 2004. EPA approval condition: NO other subsequent deadlines (in particular the 6-months of secondary testing which includes August, 2004) will be affected. OFE May 3, 2004 letter claims Force Majeur for delay. EPA June 7, 2004 letter to OFE clarifies we do not believe the claims in OFE's May 3, 2004 letter represent Force Majeure events. We indicate we do not need to decide this question since we agreed to extension.
Submit results of preliminary testing	July 12, 2004	August 11, 2004	Yes	August 10, 2004	**LATE** **OFE submitted request for extension AFTER due date (extension request submitted July 23, 2004).**
				August 13, 2004	August 10, 2004 phone call with OFE. Letter dated August 13, 2004, approved this extension date, citing August 10, 2004 call. August 13, 2004 letter says U.S. EPA is entitled to STIPS but will hold in abeyance... "as long as all other future deadlines are met. If any future deadlines are missed, EPA reserves the right to request all penalties associated with this required report". August 13, 2004 letter clarifies proposed changes to PM Plan for Croton to further decrease emissions must be submitted with stack test report. August 13, 2004 letter states OFE must submit proposed changes to Ammonia Plan. August 13, 2004 letter states EPA must receive the prosals (i.e PM and Ammonia Control Plan changes) as soon as possible since paragraphs 11, 16 and 29 in Attachment A require a period of six (6) continuous months of testing that shall include August, 2004.

ATTACHMENT 1 (Cont.)

CD-Requirement	Date Due	Date Submitted/ Completed	Extension(s) Given	Extension Due Date	Comments
Submit results of preliminary testing (cont.)					August 13, 2004 letter clarifies the previous extension was granted with the understanding that six continouos months of testing [for ammonia and PM] would commence according to schedule and include the month of August, 2004.
Submit proposed changes to PM control plan	August 13, 2004	October 29, 2004	No	N/A	**LATE** This is based on August 13, 2004 letter which says submit proposed changes with stack test results. OFE behind in submitting changes, missed August, 2004 test date and had not submitted PM Control alternatives so meeting in DC to get OFE back on track. This option was provided in an October 13, 2004 letter which was drafted following an October 5, 2004 meeting with OFE.
			Yes	November 1, 2004	EPA approved October 29, 2004 plan on December 3, 2004. OFE submitted addendum to approved PM Plan February 1, 2005. EPA approved addendum February 18, 2005.
Begin 6-months of secondary testing which must include August, 2004	August 1, 2004		No	N/A	**LATE**
	January 17, 2005				This date is based on 45-days after EPA approval of October 29, 2004 PM Control Plan (approval letter dated December 3, 2004).
	February 1, 2005		No	N/A	October 13, 2004 letter said testing must begin February 1, 2005 and continue through August 31, 2005. As of March 31, 2005, no preliminary or secondary testing has begun for PM at Croton facility. 114 Response says OFE has installed water impaction system on one fan March 18, 2005. 114 Response says OFE is "...informally evaluating its effectiveness before proceeding with formal testing".
Complete secondary testing	January 31, 2005		No	N/A	**LATE** Original due date based on 6-months of continuous testing under Consent Decree which must include August, 2004.
	August 31, 2005		No	N/A	Due date based on October 13, 2004 letter.

ATTACHMENT 2

OFE Timeline/Chronology For Consent Decree Requirements
Marseilles Facility/Mount Victory Facility - PM Control Plan

CD-Requirement	Date Due	Date Submitted/ Completed	Extension(s) Given	Extension Due Date	Comments
Submit PM control plan for particulate impaction system	March 15, 2004	March 15, 2004	No	N/A	OFE submission letter dated May 17, 2004 cites "EPA's April 19, 2004 comment letter on the proposed PM and Ammonia Control Plans".
Install particulate impaction system at one fan for preliminary testing	July 14, 2004	June 07, 2004	No	N/A	Comments provided April, 2004. Deficient QAPP. Revised plan submitted May 17, 2004. Written approval June 14, 2004.
Begin preliminary testing of particulate impaction system	June 07, 2004	June 07-14, 2004	No	N/A	
Submit results of preliminary testing	June 28, 2004	July 06, 2004	No	N/A	**LATE**
Submit proposed changes to PM control plan	July 05, 2004	None	No	N/A	No changes proposed for PM control plan.
Install particulate impaction system in full barn	August 23, 2004	July 30, 2004	No	N/A	
Begin 6-months of secondary testing which must include August, 2004, for particulate impaction system	August 1, 2004	August 1, 2004	No	N/A	
Begin simultaneous secondary testing at control barn of comparable design, age, chicken population and other relevant parameters	August 1, 2004	August 1, 2004	No	N/A	This completion date assumes barns were similar. Approved QA/QC Plan says bird age is 82 and 70 weeks [i.e., age difference of 12 weeks (page 28)]. Bird age was 72 weeks difference. Typical life expectancy of bird is 120 weeks. Bird variety differs in barns.
Submit summary of validated data-Month 1	September 30, 2004	October 14, 2004	No	N/A	**LATE**
Submit summary of validated data-Month 1-2	October 31, 2004	November 30, 2004	No	N/A	**LATE** October 13, 2004 letter approves submission within 60-days
Submit summary of validated data-Month 1-3	December 31, 2004	December 30, 2004	No	N/A	

ATTACHMENT 2 (cont.)

CD-Requirement	Date Due	Date Submitted/ Completed	Extension(s) Given	Extension Due Date	Comments
Submit summary of validated data-Month 1-4	January 31, 2005	January 31, 2005	No	N/A	
Submit summary of validated data-Month 1-5	February 28, 2005	February 28, 2005	No	N/A	
Complete secondary testing for particulate impaction system	January 31, 2005	January 31, 2005	No	N/A	Not explicit end date in CD. Is 6-months of continuous testing, including August, 2004.
Submit final month of validated data	April 1, 2005		No	N/A	**LATE** As of April 6, 2005, no final month of data has been submitted.
Submit conclusions regarding annual emission rate for particulate impaction system as PM control.	May 1, 2005		No	N/A	
Submit any proposed changes to PM control plan to increase efficacy of system.	May 1, 2005		No	N/A	

ATTACHMENT 3

OFE Timeline/Chronology For Consent Decree Requirements
Marseilles Facility/Mount Victory Facility - Ammonia Control Plan

CD-Requirement	Date Due	Date Submitted/ Completed	Extension(s) Given	Extension Due Date	Comments
for particulate impaction system	March 1, 2004	March 15, 2004	No	N/A	**LATE** OFE submission letter dated May 17, 2004 cites "EPA's April 19, 2004 comment letter on the proposed PM and Ammonia Control Plans". Initial comments April 19, 2004 Revised plan submitted May 17, 2004 Written approval June 14, 2004
Commence bench scale testing of enzyme additive.	July 14, 2004	April 6, 2004	No	N/A	
Submit results of bench scale testing	May 30, 2004	June 25, 2004 21	No	N/A	**LATE** EPA disapproved enzyme additive as control, based on bench scale test results.
Submit revisions to ammonia control plan.	July 30, 2004	July 27, 2004	No	N/A	Not explicit date in CD but latest to allow review, approval and testing to include August, 2004. OFE reproposed enzyme additive at higher application rate. Not acceptable since 5-times the recommended application rate used in bench scale testing and NO reductions occurred. Enzyme additive disapproved second time by EPA. **September 9, 2004 letter from EPA to OFE says EPA understands OFE is in violation of the requirement of the Consent Decree, although OFE has not provided the notice of such violation required by paragraph 23(a) of the Consent Decree.**
Commence application of enzyme additive or implement alternative ammonia control system in full barn.	August 1, 2004	December 11, 2004	No	N/A	Implementation due date required to satisfy testing requirement (to include August, 2004). OFE proposed enzyme additive third time (September, 2004). EPA calls meeting in DC with OFE on October 5, 2004. EPA disapproves enzyme additive third time (October 13, 2004) OFE submits revised ammonia control plan (October 13, 2004) which includes implementing new feed additive (Rose Acres Feed). EPA approves Rose Acres feed additive (November 13, 2004).

ATTACHMENT 3 (cont.)

CD-Requirement	Date Due	Date Submitted/ Completed	Extension(s) Given	Extension Due Date	Comments
Begin 6-months of secondary testing which must include August, 2004, for ammonia control.	August 1, 2004	December 11, 2004	No	N/A	**LATE** Due date (based on final written approval, October 13, 2004), would be December 13, 2004.
	February 1, 2005	December 15, 2004			This date is based on new test schedule outlined in ammonia control plan approval letter (October 13, 2004). According to 114 response, testing ended of February 1, 2005. February 15, 2005 through March 28, 2005, according to 114 response . **CD requires 6-months of testing, OFE only did 1.5-months.**
Begin simultaneous secondary testing at control barn of comparable design, age, chicken population and other relevant parameters	August 1, 2004	August 1, 2004	No	N/A	This date assumes barns were similar. Approved QA/QC Plan says bird age is 82 and 70 weeks [i.e., age difference of 12 weeks (page 28)]. Bird age was 72 weeks difference. Typcial life expectancy of a caged layer hen is 120 weeks. Bird variety in barns were different.
	February 1, 2005	August 31, 2005			Approval letter establishes new testing schedule. This due date caused by LATE submission of approvable ammonia control plan.
Submit summary of validated data-Month 1	February 11, 2005	Febuary 28, 2005	No	N/A	**LATE** This due date based on starting ammonia testing December 13, 2004.
Submit summary of validated data-Month 1-2	March 31, 2005	March 21, 2005	No	N/A	This due date based on starting ammonia testing December 13, 2004.
Complete secondary testing for ammonia control system	January 31, 2005 August 31, 2005		No	N/A	This date is original due date under CD. This date based on end date in approval letter.

ATTACHMENT 4

OFE STIPULATED PENALTY WORKSHEET

Violation (Compliance or Reporting)	Violation Description	Total Number of Days Past Due	STIP Category (day)	Days per STIP Category	Penalty for STIP Category	STIPS Totals	Comments
Compliance 1	Submit preliminary testing results for Mt. Victory	8	1st - 14th	8	$500.00	$4,000.00	
	particulate impaction system		15th - 30th		$750.00	$0.00	
			31st - beyond		$1,500.00	$0.00	
Compliance 2	Complete M5/17 testing at Croton for bird variety	27	1st - 14th	14	$500.00	$7,000.00	
	higher fat/oil feed		15th - 30th	13	$750.00	$9,750.00	
			31st - beyond		$1,500.00	$0.00	
Compliance 3	Submit M5/17 testing results for Croton bird variety	31	1st - 14th	14	$500.00	$7,000.00	
	higher fat/oil feed		15th - 30th	16	$750.00	$12,000.00	
			31st - beyond	1	$1,500.00	$1,500.00	
Compliance 4	Submit proposed changes to PM Plan for Croton	110	1st - 14th	14	$500.00	$7,000.00	
	Facility		15th - 30th	16	$750.00	$12,000.00	
			31st - beyond	80	$1,500.00	$120,000.00	
Compliance 5	Commence 6-months of testing at Croton for PM	73	1st - 14th	14	$500.00	$7,000.00	Calculated out through March 31, 2005
	to include August, 2004		15th - 30th	16	$750.00	$12,000.00	(01/17/2005, therefore 73 days)
	(within 45-days of EPA approval-begin 01/17/2005)		31st - beyond	43	$1,500.00	$64,500.00	
Compliance 6	Include Croton barns not converted to belt battery	90	1st - 14th	14	$500.00	$7,000.00	
	in Ammonia Control testing and implementation		15th - 30th	16	$750.00	$12,000.00	
			31st - beyond	60	$1,500.00	$90,000.00	
Compliance 7	Submit Ammonia Control Plan for EPA review	14	1st - 14th	14	$500.00	$7,000.00	
	and approval		15th - 30th		$750.00	$0.00	
			31st - beyond		$1,500.00	$0.00	
Compliance 8	Submit results of bench scale testing under	25	1st - 14th	14	$500.00	$7,000.00	
	Ammonia Control Plan		15th - 30th	11	$750.00	$8,250.00	
			31st - beyond		$1,500.00	$0.00	
Compliance 9	Submit proposed changes to Ammonia Plan for	55	1st - 14th	14	$500.00	$7,000.00	This is based on Paragraph 20 in CD where initial plan
	Mount Victory Facility		15th - 30th	16	$750.00	$12,000.00	was deficient and changed plan did not propose any
			31st - beyond	25	$1,500.00	$37,500.00	changes. Failed to submit from July 30, 2004 until 09/24/2004
Compliance 10	Commence 6-months of testing at Mount Victory		1st - 14th	14	$500.00	$7,000.00	Calculated out through March 31, 2005
	for Ammonia to include August, 2004		15th - 30th	16	$750.00	$12,000.00	Note: Only tested for approximately 1.5 months, then stopped
	(within 60-days of EPA approval-begin 12/13/2004)		31st - beyond	29	$1,500.00	$43,500.00	
Reporting 1	Submit first month of validated PM data for	14	1st - 14th	14	$250.00	$3,500.00	
	Mount Victory Facility		15th - 30th		$500.00	$0.00	
			31st - beyond		$1,000.00	$0.00	
Reporting 2	Submit second month of validated PM data for	30	1st - 14th	14	$250.00	$3,500.00	
	Mount Victory Facility		15th - 30th	16	$500.00	$8,000.00	
			31st - beyond		$1,000.00	$0.00	
Reporting 3	Submit first month of validated Ammonia data for	17	1st - 14th	14	$200.00	$2,800.00	
	Mount Victory Facility		15th - 30th	3	$500.00	$1,500.00	
			31st - beyond		$1,000.00	$0.00	
Reporting 4	Submit first month of validated PM data for	(243)	1st - 14th		$200.00	$0.00	[RESERVED]
	Croton Facility		15th - 30th		$500.00	$0.00	
			31st - beyond		$1,000.00	$0.00	
						$533,300.00	

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGIONS 5
77 WEST JACKSON BOULEVARD
CHICAGO, IL 60604-3590

REPLY TO THE ATTENTION OF:

VIA ELECTRONIC AND U.S. MAIL

March 2, 2007

Mr. Brian M. Babb, Esq.
Keating, Muething & Klekamp, P.L.L.
1400 Provident Tower
One East Fourth Street
Cincinnati, Ohio 45202
bbabb@kmklaw.com

Re: Addendum to February 2, 2007 Letter Approving Ohio Fresh Eggs, LLC's November 1, 2006 Revised Ammonia Emissions Control Design and Implementation Plan for Ohio Fresh Eggs, LLC's Croton, Marseilles, and Mt. Victory, Ohio Facilities (U.S. v. Buckeye Egg Farm, L.P., et al. – Civil Action No. 3:03 CV 7681

Dear Brian:

As we discussed on February 28, 2007, this letter confirms that the U.S. Environmental Protection Agency (EPA) approves the following changes to U.S. EPA's February 2, 2007 letter approving Ohio Fresh Eggs, LLC's (OFE's) November 1, 2006 Revised Ammonia Emissions Control Design and Implementation Plan for Ohio Fresh Eggs, LLC's Croton, Marseilles, and Mt. Victory, Ohio Facilities (Ammonia Control Plan).

We agreed to the following during our discussions:

1. OFE will commence conducting emissions testing using the secondary test methods for ammonia over a continuous three-month period beginning on or about May 1, 2007. This will allow for a change over in the birds in both the test barn and the control barn. The change over will provide birds of comparable age in each barn. The manure pits will be cleaned out and re-bedded with a fresh layer of manure at the same time as the change over. The manure for both the test barn and the control barn will be from the same barn.

2. OFE proposes to implement and test an enhanced fiber diet, as well as five best management practices, to reduce ammonia emissions by fifty percent or more as required by the Consent Decree. OFE intends to use dry distiller grain solids (DDGS) as its enhanced fiber. DDGS is a secondary product of ethanol production from corn.

3. The five approved best management practices OFE will test are identified in our February 2, 2007 letter and include: 1) operation of 40 pit fans in the manure pit; 2) reduction in the amount of crude protein in the feed rations; 3) reduction in the amount of chlorine in the feed ration through the use of bicarbonate; 4) implementation of improved waterline leak management practices; and 5) reducing the number of birds to meet the United Egg Producers (UEP) recommendations.

4. OFE will begin the approved emissions testing for ammonia by implementing the DDGS feed additive and all five best management practices (OFE will start with a reduced number of birds in the test barn - the one with the DDGS fiber enhanced diet - compared to the control barn). This diet and best management practices will be maintained for, at least, the first one and one-half months of testing.

5. OFE will suspend, in series, each of three best management practices (BMPs) during, at most, the second one and one-half months of testing. The BMPs to be suspended are: 1) reduction in the amount of crude protein in the feed rations; 2) reduction in the amount of chlorine in the feed ration through the use of bicarbonate; and 3) operation of 40 pit fans in the manure pit. The order of suspension of the BMPs will be left to OFE's discretion as well as the specific timing of suspension. It is anticipated, however, that OFE will suspend one BMP approximately once every two weeks to allow for the barn to adjust to the change. Once a BMP is suspended, it will remain suspended until after the three consecutive months of testing are complete. For example, if OFE suspends the reduced crude protein BMP first (around the last two weeks in June, if testing begins May 1, 2007), a reduced crude protein will not be reintroduced into the feed until after testing is complete. The second BMP to be removed may be the reduced chlorine in the feed (around the first week in July if testing begins May 1, 2007). At this stage, two of the three BMPs (reduced crude protein and reduced chlorine) will have been suspended and remain suspended until testing is complete. The third and final BMP to be suspended would be operation of the pit fans (around the last two weeks in July if testing begins May 1, 2007). The purpose of this BMP suspension plan is to allow OFE and EPA to review the effectiveness (or lack thereof) of each BMP and its impact on ammonia reductions.

6. OFE will document when each BMP was suspended and include such documentation in the validated raw data and in the final report on ammonia testing. OFE will also review the data and report the apparent effect of the BMP suspension based on the validated data (for example, if the data shows an increase in ammonia emissions – say a five percent increase – occurred after suspension of crude protein, OFE would note that the data indicates reducing crude protein in the bird's diet can provide an additional five percent reduction in ammonia emissions).

Additional Topics Discussed:

OFE raised some concerns about timing of BMP suspension. This is generally referring to concerns if the ammonia emissions reductions are hovering just around 50 percent prior to suspension of a BMP. OFE was concerned that the actual reduction prior to suspension of a certain BMP may meet the 50 percent reduction requirement, but by suspending the BMP at that moment, OFE may not get the total reduction achieved by the BMP. EPA believes that by leaving the specific timing of BMP suspension to OFE's discretion, this concern is addressed.

This letter identifies a schedule of suspension every two weeks as a general time frame, but a few days more or less than two weeks will not be of concern to EPA. However, EPA would not expect OFE to wait for four weeks to suspend one BMP and then, the next day, suspend a second BMP.

Along the same lines, if the implementation of the DDGS and all five BMPs appear to result in ammonia emissions reductions equaling approximately 50 percent or less, OFE need not suspend any BMPs. Such a situation would indicate that the DDGS as well as all five BMPs are necessary to achieve the 50 percent or more reduction required by the Consent Decree. Although not expected, if the implementation of two BMPs have synergistic effects on ammonia emissions (for example by using one BMP, the effectiveness of another in reducing ammonia emissions is decreased), then OFE may choose to suspend one or the other to achieve the maximum ammonia reductions possible.

OFE will modify the quarterly report format to be more in line with the current control technologies being tested and/or implemented (i.e., the electrostatic space charging system - ESCS). Quarterly reports should include updates on the status of the ESCS across all barns at OFE's three facilities (Croton, Marseilles and Mt. Victory), rather than stating the particulate impaction system curtain is not being used. Quarterly reports should also include updates on the belt battery installations occurring at the Croton facility, and the status of implementing the enhanced fiber diet (for the planned testing, as well as once testing is complete – if the enhanced fiber diet is effective in achieving the necessary reductions).

OFE also agreed it would put together a document outlining its proposed "improved waterline leak prevention program" BMP. The document should highlight the current practices as well as the "improvements" being implemented through this BMP. OFE may elect to include updates on the implementation of this BMP across all barns at its facilities in the quarterly reports as well. Although it is a proposed BMP for ammonia control, it may also have impacts on fly problems and other concerns raised by the State in the past. Outside of the Consent Decree context, it seems logical that OFE would desire an improved leak prevention program.

Conclusions:

We approve OFE's proposed ammonia control plan dated November 1, 2006, as set forth in U.S. EPA's February 2, 2007 letter, as amended by this addendum. This approval is granted under the conditions identified above. OFE must realize the proposals made for an enhanced fiber diet and BMPs (bird numbers, fan use, etc.) will all require various records and reports be maintained. There must also be an effective means through which the requirements can be enforced to assure compliance with the fifty percent or more ammonia reduction requirements of the Consent Decree on a continuous basis, once implemented.

If you have any questions regarding this letter or the conditions outlined above, please call me at (312) 886-6237.

Sincerely,

Mary T. McAuliffe

Mary T. McAuliffe
Associate Regional Counsel

cc: Deborah M. Reyher
Kevin Vuilleumier
Cary Secrest
Sanda Howland

KMK | Keating Muething & Klekamp PLL
ATTORNEYS AT LAW

RECEIVED
JUN 02 2006
AIR ENFORCEMENT BRANCH
U.S. EPA, REGION 5

BRIAN M. BABB
DIRECT DIAL: (513) 579-6963
FACSIMILE: (513) 579-6457
E-MAIL: BBABB@KMKLAW.COM

May 31, 2006

Via UPS
Chief, Environmental Enforcement Section
Environment and Natural Resources Division
U.S. Department of Justice
601 D. Street, N.W.
Mailroom 2121
Washington, D.C. 20004

Via E-Mail
Mr. Kevin L. Vuilleumier, Environmental Engineer
Air Enforcement and Compliance Assurance Branch
U.S. Environmental Protection Agency
Region 5-AE-17J
77 West Jackson Boulevard
Chicago, Illinois 60604-3507

Via UPS
Compliance Tracker
Air Enforcement and Compliance Assurance Branch
U.S. Environmental Protection Agency
Region 5, AE-17J
77 West Jackson Boulevard
Chicago, Illinois 60604

Via E-Mail
Mr. Cary Secrest
U.S. Environmental Protection Agency
Ariel Rose Building, Room 2119
1200 Pennsylvania Avenue, N.W.
Washington, D.C. 20004

Via UPS
Director, Office of Regulatory Enforcement
Office of Enforcement and Compliance Assurance
U.S. Environmental Protection Agency
Mail Code 2241A
1200 Pennsylvania Avenue, N.W.
Washington, D.C. 20460

Via E-Mail
Ms. Mary T. McAuliffe
Associate Regional Counsel
U.S. Environmental Protection Agency
Region 5
77 West Jackson Boulevard
Chicago, Illinois 60604-3590

RE: United States v. Buckeye Egg Farm, L.P., et al. – Civil Action 3:03 CV 7681. Final Report of the Test of Electrostatic Space Charge System for Ohio Fresh Eggs' Mt. Victory Facility

Dear Sir/Madam:

As required under Attachment A of the Consent Decree in the above-referenced matter, I have enclosed a copy of the Final Report of the Test of the Effects of the Electrostatic Space Charge System on Particulate Matter Emissions in a High-Rise Layer Barn for Ohio Fresh Eggs' Mt. Victory Facility. Also enclosed is Ohio Fresh Eggs' Certification for this Report.

Should you need additional information, please contact me. Thank you for your consideration of this matter.

Very truly yours,

KEATING MUETHING & KLEKAMP PLL

By: Brian M. Babb

Brian M. Babb

Enclosures

cc: Mr. Donald C. Hershey
Dr. Albert J. Heber

1653725.1

CERTIFICATION

I certify under penalty of law that this document and any attachments to it were prepared under my direction or supervision in accordance with a system designed to ensure that qualified personnel properly gather and evaluate the information submitted. Based on my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing and willful submission of a materially false statement.

OHIO FRESH EGGS, LLC

Donald C. Hershey

Donald C. Hershey, Manager

1232938.1

Effects of Electrostatic Space Charge System on Particulate Matter Emissions from High Rise Layer Barn

Final Report

RECEIVED
JUN 02 2006
AIR ENFORCEMENT BRANCH,
U.S. EPA, REGION 5

to

Ohio Fresh Eggs, LLC

11492 Westley Chapel Rd, Croton, OH 43013

by

Albert J. Heber, Teng Teeh Lim, Ji-Qin Ni, Samuel M. Hanni, Claude A. Diehl, Chaoyuan Wang, and Lingying Zhao

Agricultural and Biological Engineering Department

Purdue University

225 S. University St.

West Lafayette, IN 47907

Phone: 765-494-1214

May 31, 2006

EFFECTS OF ELECTROSTATIC SPACE CHARGE SYSTEM ON PARTICULATE MATTER EMISSIONS FROM HIGH-RISE LAYER BARN

Albert J. Heber, Teng Teeh Lim, Ji-Qin Ni, Samuel M. Hanni, Claude A. Diehl, Chaoyuan Wang, and Lingying Zhao

Abstract

Emission rates of particulate matter (PM), including PM_{10} (particulate matter of 10 µm and smaller) and TSP (total suspended PM), were measured at two 169,000-hen capacity high-rise layer barns (Barns 1 and 2). The tests were conducted at the Mt. Victory facilities owned by Ohio Fresh Eggs to evaluate baseline and mitigated emission rates, as required by a federal consent decree. Continuous emission data was collected from September 1, 2005 to March 4, 2006. An Electrostatic Space Charge System (ESCS) was installed and tested for PM removal efficacy in the manure pit of Barn 2. Concentrations of PM_{10} and TSP were measured at representative barn exhaust fans and ambient locations (PM_{10} only). Concentrations of PM_{10} were measured continuously using tapered element oscillating microbalance monitors. TSP concentrations were evaluated gravimetrically with three replications per sampling event, collected one to three times per week per barn. Other measured variables included inside and outside temperature and relative humidity, bird activity, building static pressure, fan operational status, and barn ventilation rate. The average daily mean untreated net emission rates ranged from 1.15 to 11.9 g d^{-1} AU^{-1} for Barn B1 and averaged 5.03 g d^{-1} AU^{-1} (14.1 mg d^{-1} hen^{-1}) for Barn 1. The ESCS operation reduced PM_{10} emission by 47% based on the overall cross-barn comparison. When the ESCS was switched off on weekends (Tests 5 to 7) for within-barn comparisons, the PM_{10} emission reduction was only 12%. The PM removal efficiency of the ESCS in Tests 5 to 7 was hindered by power unit failures and performance or the ESCS, and introduction of a new flock of hens into Barn 2. Higher reductions were achieved (48% PM_{10} reduction in Test 1, and 36% PM_{10} reduction in Test 7, after the new hens had adapted to their new environment) at certain test periods. The mean TSP emission rates were 49.1, 35.1, and 43.5 g d^{-1} AU^{-1} (252, 238 and 191 mg/s) for Barn 1, untreated Barn 2, and treated Barn 2, respectively. Barn 2, with the ESCS, had 18% less overall gross TSP emissions than Barn 1. When comparing the overall treated and untreated Barn 2 emissions, the ESCS reduced the TSP emission rate by 19%.

Introduction

Ohio Fresh Eggs, LLC owns egg production facilities located in Croton, Licking County, Ohio ("Croton Facilities"), Harpster, Wyandot County, Ohio ("Marseilles Facilities"), and LaRue, Hardin County, Ohio ("Mt. Victory Facilities"). The facilities are subject to the requirements of the Consent Decree in *United States vs. Buckeye Egg Farm, L.P., et al.,* United States District Court, Northern District of Ohio, Western Division, Civil Action No. 3:03CV7681.

The Electrostatic Space Charge System (ESCS) was tested from September 1, 2005 to March 4, 2006 in Barn 2 (B2) of Ohio Fresh Egg's Mt. Victory laying facility (Site #5). The ESCS was installed and operated in B2, while Barn 1 (B1) served as the untreated barn for comparison. An on-farm instrument shelter (OFIS) was used to house instruments to measure air emissions from the two mechanically-ventilated barns.

The test was conducted at the site of the six-month Particulate Impaction System test that ended on January 31, 2005 (Lim et al., 2005). A system for applying a litter amendment called Alum (Aluminum Sulfate) was also installed in B2 to control ammonia. The ESCS was initially operated for several days without Alum, followed by an independent (with the ESCS off) test of Alum, and another independent test of the ESCS. By the end of September 2005, both Alum and ESCS were operated simultaneously. In order to establish more untreated PM emission data, the ESCS was turned off on the weekend starting November 28, 2005. The tests were conducted by Dr. Teng Teeh Lim, Purdue University, and Mr. Chaoyuan Wang, Ohio State University, with supervision and oversight by Dr. Albert Heber, Purdue University.

This was the first test of an electrostatic PM removal system ever conducted in a large layer barn. The objective of the test was to determine efficacy of ESCS in controlling emissions of particulate matter (PM) from a high-rise layer barn. Specifically, the objectives were to evaluate whether the ESCS has the potential to reduce PM_{10} and TSP concentrations and emission rates.

Methods and Procedure

Description of Laying Barn

The two caged-hen layer barns at Mt. Victory, Ohio (20449 County Rd 245, Mt Victory, OH 43340) were built in 1994, along with 12 other barns at the facility. The barns were 201 m x 20.7 m, oriented E-W, and spaced 20.7 m apart (Figure 1). Each barn housed about 169,000 hens in eight rows of 4-tier crates in the 3.3-m high upper floor. Manure was scraped off boards under the cages into the 3.2-m high first floor. Manure drying on the first floor was enhanced with eighteen, 918-mm dia. auxiliary circulation fans (Model VG36DM3F, J&D Manufacturing, Eau Claire, WI).

The two barns were the same that were used in the previous test of the Particulate Impaction Curtain. A major difference was the locations of the manure drying fans in the manure storage pit on the first floor of the barn. The 918-mm dia. auxiliary circulation fans (Model VG36DM3F, J&D Manufacturing, Eau Claire, WI) were repositioned and rearranged to generate air patterns in a 45-degree angle with the length of the barn to minimize exposure of the fans to the sprayed Alum solution. Birds were placed in Barns 1 and 2 in July, 2004 and February, 2005, respectively.

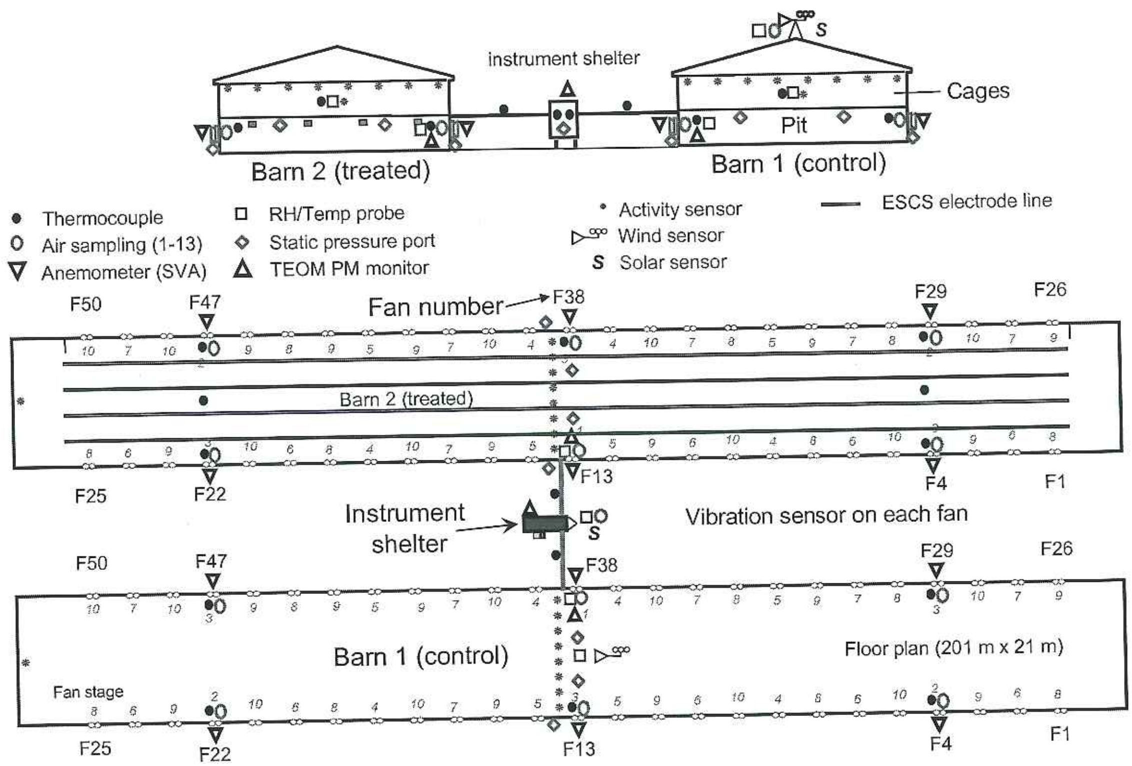

Figure 1. Layout and Cross-Section of High-Rise Layer Barns Showing Monitoring Locations.

Ventilation air was brought into the barns from the attic through temperature-adjusted baffled ceiling air inlets above the cages, and exited through continuous manure slots beneath each cage row into the pit. There were twenty-five, 1.2-m (48-in.) dia. belted exhaust fans (fans 1-25) (Advantage Fan Model AT481Z3CP, Aerotech, Lansing, MI) distributed along the east sidewall and 25 on the west sidewall (fans 26-50), Figure 1. The fans were spaced 7.3 m (24 ft.) apart and were grouped into 10 ventilation stages for this monitoring test. Each barn was originally ventilated in 26 rotating stages. The first, second and third stages consisted of 1, 2 and 3 fans each. Eggs were removed by conveyors into the egg processing plant. The cage lights were shut off for several hours each night. Egg production and water and feed consumption were also recorded automatically, while daily hen mortalities were recorded manually by the collaborating producer.

Description of Electrostatic Space Charge System

The ESCS (Baumgartner Environics Inc., Olivia, MN) utilizes electrodes to impart electrical charges to particles as they move through the charging field. The charged particles are then attracted to a ground panel, the floor, the manure, and other grounded surfaces. Power supplies with high voltages of 25K–30K VDC and about 2 mA capacity supplied cables with 24 ion discharge needles per foot. Four cables ran along the entire length of Barn 2 and were spaced uniformly across the width of the barn (Figure 1). Operation of each ESCS electrode line was monitored by continuously measuring and recording the voltages and current draws of from each of the four power supply units.

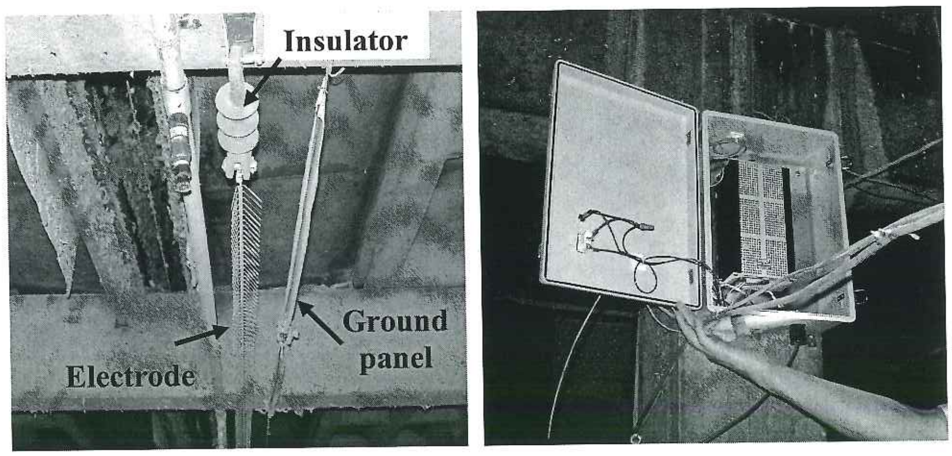

Figure 2. ESCS electrodes and ground panel installed at the ceiling of the manure storage pit (left), and the modular high-voltage supply unit (right).

Experimental Design

Several tests were conducted during the six-month evaluation of the ESCS. In Test 1, the ESCS was tested independently from September 1-10, 2005. The tests were conducted in conjunction with the applications of Aluminum Sulfate (Alum) and Aluminum Chloride, September 11, 2005 to March 31, 2006. Both the ESCS and Alum tests were conducted in B2, while B1 served as an untreated (control) barn. In Test 2, the Alum was tested independently from September 11-20, 2005. The ESCS was tested independently again from September 21-29, 2005, which was Test 3. The Alum-spraying system and ESCS again operated simultaneously between September 30 and November 21, 2005 (Test 4). It is assumed that the Alum spraying did not affect the PM concentration, since it was sprayed only three seconds per hour. With this assumption, the results of Test 2 can be compared with Tests 1, 3 and 4 to assess the PM reduction potential of ESCS.

Table 1. Tests conducted during study.

Test	Date	Description
1	9/1-9/10	ESCS only
2	9/11-9/20	Alum only
3	9/21-9/29	ESCS only
4	9/30-11/21	Alum+ESCS
5*	11/22-12/12*	Alum + partial ESCS operation
6	12/23-1/19	Alum + partial ESCS†, new hens in B2
7	1/20-3/4	Alum+ESCS

* ESCS was switched off on weekends, starting November 28, 2005.

† ESCS was repaired; all four lines working again on January 15, 2006.

In Test 3, the ESCS cable and electrodes were moved about 15 cm away from the Alum-spraying system to avoid damage due to high voltages. Additional adjustment was made on September 26, 2005 to increase the ESCS voltage. There were also two ESCS failures

(75% operation, as 1 of 4 lines were down) for over a month. A power supply unit (line 2) of the ESCS was found malfunctioned from November 22 to December 12, 2005, while unit 3 also failed from December 6, 2005 to January 3, 2006. A short malfunctioning period (lasted from January 12-15, 2006) was also observed for the ESCS line 4. Since there were several power supply unit failures during this test period, part of the data was grouped into one individual test (Test 5) to better study the ESCS performance.

Starting on November 28, 2005, the ESCS lines were switched off at noon every Friday, and left so until noon, Monday, to establish the B2 untreated baseline data. Barn 2 was emptied of old hens on December 12, 2005, and was restocked with new birds on December 18, 2005. Only full barn data was included in this data set to avoid biasness. Since it was expected that the new flock of hens would create more PM emission while they were adapting to the new environment, the first five weeks of data was separated as Test 6. In Test 7, after January 20, 2006, the PM concentrations in B2 seemed to have stabilized.

Instrument Shelter and Raceway

An air-conditioned trailer (7.3 m x 2.3 m x 2.1 m) was located between the two barns to protect instruments and provide storage and on-site laboratory and office space for researchers. The on-farm instrument shelter (OFIS) was connected to the two barns using suspended and heated 10-cm ID PVC pipe raceways, which protected signal cables and vacuum tubes. The TEOM vacuum tubes and air sampling tubes were bundled together with heating tape and insulated. The temperatures (three points per raceway) were monitored closely for heating control to prevent condensation in the tubes.

Particulate Matter Concentration

Particulate matter (PM_{10}) concentrations were measured with a continuous ambient PM_{10} monitors (Tapered Element Oscillating Microbalance, TEOM Model 1400a, Rupprecht & Patashnick, Albany, NY) immediately upstream of Fan 38 in B1 and Fan 13 in B2. The TEOM pumps and controllers were stationed in the OFIS, while the sampling inlets and sensor units were positioned in the two barns. Ambient PM_{10} concentration was measured by placing a third TEOM monitor with inlet positioned on top of the OFIS (Figure 1). The sample stream temperature was maintained at 50°C following the original settings. The reported PM concentrations were adjusted to one atmosphere and 20°C.

Concentrations of total suspended particulate (TSP) were measured gravimetrically with critical venturi to control sampling flow rate (Jerez et al., 2005). A three-point sampler that draws 20 L/min of sampling air through each of three 37-mm glass fiber filters (loaded in 3-piece open-face filter holders) was located at the inlets of the exhaust fans next to the TEOM inlets. TSP sampling was conducted one to three times per week, with sampling periods of one to three days. The isokinetic sampling nozzles were located at three different heights within the fan inlet (less than 0.5 m from the fan impellers). The filter holders were fitted with isokinetic sampling nozzles that pointed into the exhaust air leaving the barns. The locations of TSP sampling heads were carefully selected to match the 2 m/s airflow speed of isokinetic sampling. The air velocities around each sampling nozzle (4-point per nozzle) were measured by using a portable vane thermoanemometer (Model 451126, Extech, Bohemia, NY).

Pressure Measurement

Differential pressures across each building sidewall as fan operating pressures were monitored continuously using differential pressure transmitters (Model 2671-100-LB11-9KFN, Setra, Boxborough, MA). Measurement range of the transmitter was ±100 Pa, with an accuracy of ±1%. The purposes of differential pressure measurements were to monitor operation of the ventilation system, and to aid in the calculation of fan airflow using fan performance curves. The pressure sensor was shunted for calibration checking and compared with an inclined manometer at various span pressures. Atmospheric pressures were monitored with barometric pressure transducers in the TEOMs

Ventilation and Environmental Variables

The operating status (on/off) of each fan stage was monitored via auxiliary contacts of fan motor control relays, backed up with either an open impeller anemometer or a vibration sensor (Ni et al., 2005) installed at each individual fan. Fan airflow capacities were measured on October 5 and 6, with a calibrated portable fan tester that consisted of multiple traversing impeller anemometers (Gates et al., 2004). During these tests, the building static pressure was recorded and the airflow was compared with the ventilation rates estimated from independent tests conducted for the fan model and published by the manufacturer. The actual fan airflow was estimated from static pressure using a fourth-order polynomial equation that was developed for each ventilation fan, based on the field test data.

The temperature and humidity of exhaust air, along with barometric pressure, were needed for volume correction to standard conditions. Copper-constantan thermocouples (Type T) were used to sense temperatures throughout the barns and in the OFIS at various locations: 1) exhaust sampling points, 2) heated raceways, and 3) trailer and instrumentation. The sensors were calibrated prior to and following the test using a constant-temperature bath.

A relative humidity (RH) and temperature (T) probe (Model HMW61, Vaisala, Woburn, MA) was collocated with each TEOM (Figure 1). Another RH/T probe (Vaisala Model Humitter 50Y) was located in an emptied cage at the center of each barn. A solar-radiation-shielded RH/T probe (Vaisala Model HMD60YO), a cup anemometer, and wind direction vane were attached to the top of the barn.

Hen activity was monitored using passive infrared motion detectors (Model SRN-2000N, ADI Inc., Bridgeview, IL) that generated voltages proportional to movement. The detectors were mounted on the ceiling above each row of cages in both barns and tilted slightly downward to face the cages.

Manure Sampling and Analysis

Manure from the layer barns was sampled monthly to determine moisture content and pH values, which are important factors affecting PM and NH_3 emissions. Thirty-six (36) surface samples were collected from randomly selected locations in each barn. After collection, the samples were put on ice and delivered to the Purdue Manure Analysis Laboratory for analysis of moisture content and pH.

Data Acquisition and Processing

A custom PC-based data acquisition and control (DAC) program was developed using LabVIEW for Windows (National Instruments Co., Austin, TX). The program communicated with DAC hardware, which included several external DAC modules and an internal card (FieldPoint and PCI 6601 DIO, National Instruments Co., Austin, TX, respectively). A separate internal DAQ card coupled with an external expansion board (PCIM-DAS1602/16 and EXP32, respectively, Measurement Computing Corporation, Middleboro, MA) provided 32 more analog input channels. Four digital input modules (Measurement Computing Corporation MiniLab™ 1008 Personal Measurement Devices) acquired digital input signals from the vibration sensors. Data acquired by the DAQ system were sampled at a frequency of 1 Hz, then averaged every 15 s and 60 s, and recorded.

A custom data processing program, CAPECAB (Calculation of Aerial Pollutant Emissions from Confined Animal Buildings), was used to process the 60-s data set (Eisentraut et al., 2004a; 2004b). PM concentrations were converted to concentrations at standard temperature and pressure (STP, 1 atm and 20°C) for calculating emissions. Average daily means (ADM) were calculated using only days with over 70% valid data (complete-data days). ADM for both barns were calculated as weighted means.

Since the PM_{10} concentrations reported by TEOMs were based on 1 atm pressure and 25°C, the gross PM_{10} emission rate was calculated as:

[illegible] (1)

Where:

E	Gross PM_{10} emission rate, µg/s
Q_0	Exhaust airflow rate at T_0, m^3/s
P_0	Pressure of exhaust air, atm
P'	Standard pressure, 1 atm
[illegible]	PM concentration recorded by TEOM in exhaust air, $\mu g/m^3$
T*	Temperature basis of TEOM reported concentrations, 25°C
T_0	Temperature of exhaust air, °C

Results

All of the reported average daily mean (ADM) or hourly mean values consisted of over 70% valid data (complete-data days or complete-data hours) to avoid biasness due to missing data. The data completeness for PM_{10} emission, in terms of the number of days with over 70% valid data, were 92% and 76% for B1 and B2, respectively. The fewer complete-data days for B2 emission rate was partially due to the changing of hen flocks, which was about 6% (11 days) of the 185 measurement days.

The basic statistics of important variables, including barn inventory, environment variables, and ADM emission values are reported in Tables 2 and 3. The monitoring test started with 158,787 and 153,660 hens, and ended with 154,729 and 157,031 hens in B1 and B2, respectively (Figure 3). A new flock of hens was introduced into B2 in mid-December 2005; thus the beginning and ending bird numbers were not the maximum and minimum values. The flocks of W36 hens in B1 and B2 were 46 and 73 weeks old when the monitoring test started, and were 72 and 29 weeks old when the test ended. The ADM bird mass was 1.40 and 1.53 kg for B1 and B2, respectively. The ADM total live mass of B1 and B2 were 440 and 468 AU (AU=500 kg live mass), respectively. B2 started with a new flock of hens which was still growing, and was gaining weight faster when newly introduced into B2 (Figure 3).

Table 2. Summary of Daily Means at Barn 1. 9/1/2005 to 3/4/2006.

Parameter	n	Min	Mean	Max	SD
Bird inventory, n	185	154,729	156,884	158,787	1237
Mean bird mass, kg/bird	185	1.37	1.40	1.45	0.02
Total live mass, AU	185	427	440	457	6.5
Temperatures, °C					
Ambient air	175	-13.1	5.65	21.7	8.81
Cages	171	20.3	23.1	26.8	1.50
Exhaust air	171	13.8	20.4	26.4	3.01
Airflow, dsm³/s	165	29.1	78.6	257	59.8
Particulate Matter (PM_{10})					
Ambient conc., μg/dsm³	170	13.2	73.8	188	37.3
Exhaust conc., μg/dsm³	170	144	475	883	135
Net emission, mg/s	168	5.95	26	60	7.74
Net emission, kg/d	168	0.51	2.21	5.21	0.67
Net emission, g d^{-1} AU^{-1}	168	1.15	5.03	11.9	1.51
Net emission, mg d^{-1} hen^{-1}	168	3.24	14.1	33.6	4.26
Total Suspended Particulate (TSP)					
Exhaust Concentration, μg/dsm³	51	1925	3129	4160	599
Emission Rate, mg/s	52	49.3	252	715	147
Emission Rate, g d^{-1} AU^{-1}	52	9.69	49.1	138	28.2

Table 3. Summary of Daily Means at Barn 2. 9/1/2005 to 3/4/2006.

Parameter	n	Min	Mean	Max	SD
Bird inventory, n	177	148,197	153,816	158,120	3365
Mean bird mass, kg/bird	180	1.12	1.53	1.66	0.11
Total live mass, AU	177	354	468	495	26.4
Temperatures, °C					
Ambient air	175	-13.1	5.65	21.7	8.81
Cages	163	15.5	21.9	27.1	3.02
Exhaust air	155	9.79	19.6	26.3	3.90
Airflow, dsm^3/s	153	31.1	84.1	287	66.3
Particulate Matter (PM_{10})					
Exh. Conc., $\mu g/dsm^3$, Untreated	46	238	613	1534	368
Exh. Conc., $\mu g/dsm^3$, Treated	99	183	494	1474	283
Untreated Emission, mg/s	45	8.80	35.0	64.5	17.6
Untreated Emission, kg/d	45	0.76	3.0	5.6	1.52
Untreated Emission, g d^{-1} AU^{-1}	45	1.66	6.71	14.8	3.68
Untreated Emission, mg d^{-1} hen^{-1}	45	4.84	19.4	36.2	9.71
Treated Emission, mg/s	95	7.02	27.5	85.0	15.0
Treated Emission, kg/day	95	0.61	2.38	7.35	1.30
Treated Emission, g d^{-1} AU^{-1}	95	1.29	5.15	17.2	3.11
Treated Emission, mg d^{-1} hen^{-1}	95	3.86	15.4	46.5	8.20
Total Suspended Particulate (TSP)					
Untreated Concentration, $\mu g/dsm^3$	9	1243	2067	3556	708
Untreated Emission Rate, mg/s	9	59.5	238	750	240
Untreated Emission Rate, g d^{-1} AU^{-1}	9	11.1	43.5	133	42.0
Treated Concentration, $\mu g/dsm^3$	38	926	2186	3858	680
Treated Emission Rate, mg/s	38	36.1	191	548	141
Treated Emission Rate, g d^{-1} AU^{-1}	38	6.36	35.1	97.7	24.8

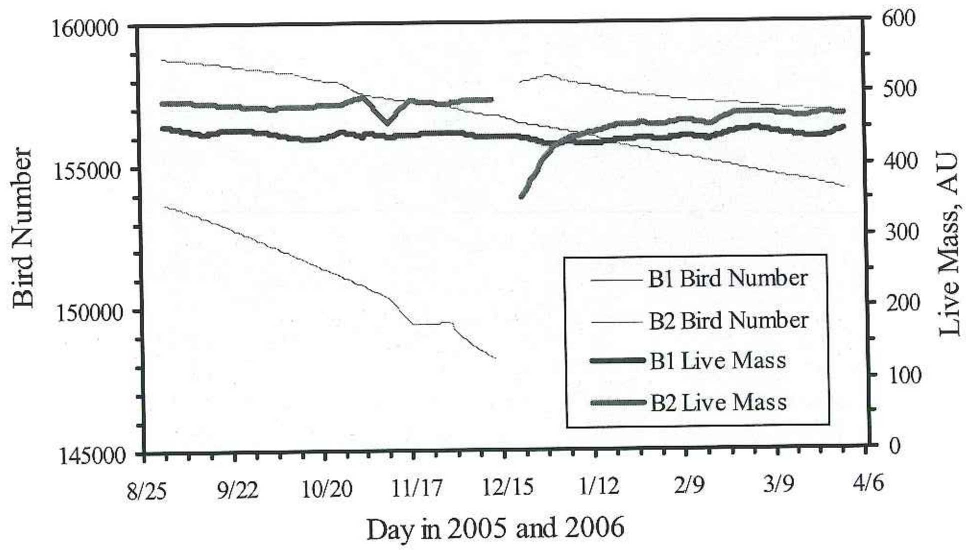

Figure 3. Bird number and total live mass.

The ADM airflow rates of B1 and B2 were 78.6 and 84.1 dsm^3/s, respectively. As expected, barn ventilation rates were generally higher in warm weather (Figure 4). Daily mean airflow rate ranged from 29 to 257 dsm^3/s for B1, and ranged from 31 to 287 dsm^3/s for B2. The ADM ambient temperature was 5.7°C (ranged from -13.1°C to 21.7°C), and was lower than the mean annual local temperature of 10.0°C. Similar polynomial equations relating airflow rate and ambient temperature were developed for each barn, suggesting that the two barns had similar ventilation rate and temperature control (Figure 5). Close correlation between the ambient temperature and barn airflow rate was also found in a previous study (Lim et al., 2005). A paired t-test was conducted to examine the barn ventilation rates, and indicated that the two were not significantly different (P=0.002).

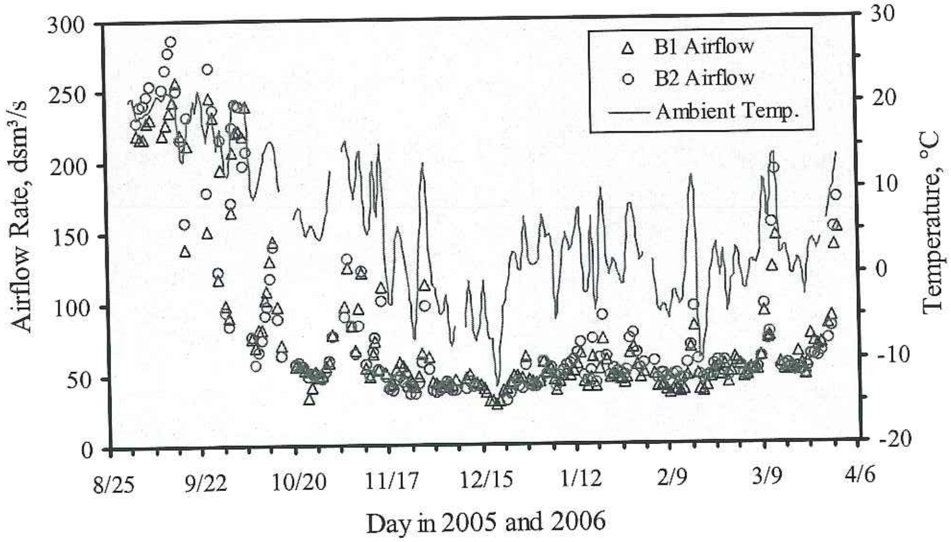

Figure 4. Barn ventilation rate and ambient temperature.

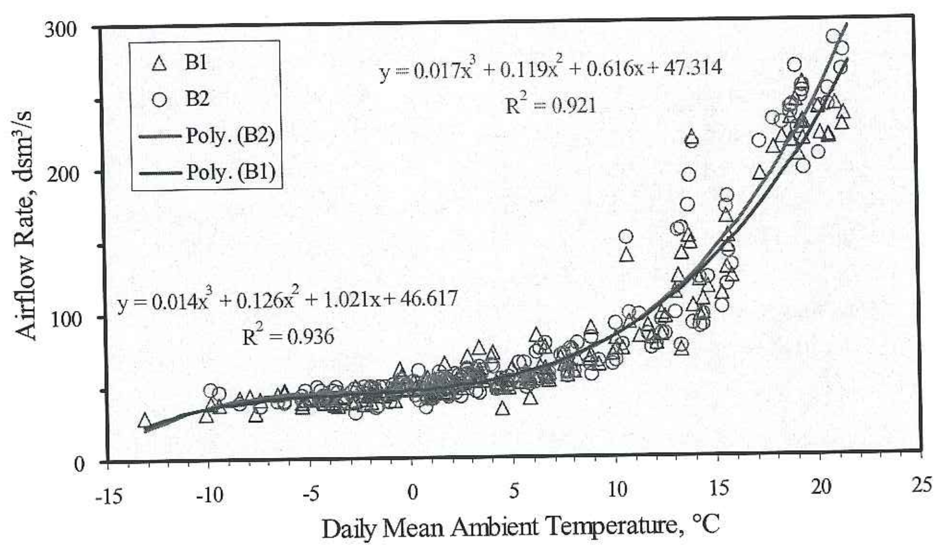

Figure 5. Influence of ambient temperature on barn ventilation rate.

The daily mean barn (cage level) and pit exhaust temperatures are presented in Figure 6. The ADM cage temperatures (centers of cages) were 23.1°C and 21.9°C for B1 and B2, respectively, and were not statistically different based on a paired t-test ($P<0.001$). However, the temperatures of B2 were maintained generally higher at the beginning of the test, and became generally lower than B1 starting in December with the new flock of hens (Figure 6). The ADM exhaust temperatures (up to six sampling locations) were 20.4°C and 19.6°C for B1 and B2, respectively. Only two thermocouples of the six installed were used to measure B2 exhaust temperatures, because the other four detected static noises from the high voltage operation of the ESCS, and were thus disconnected.

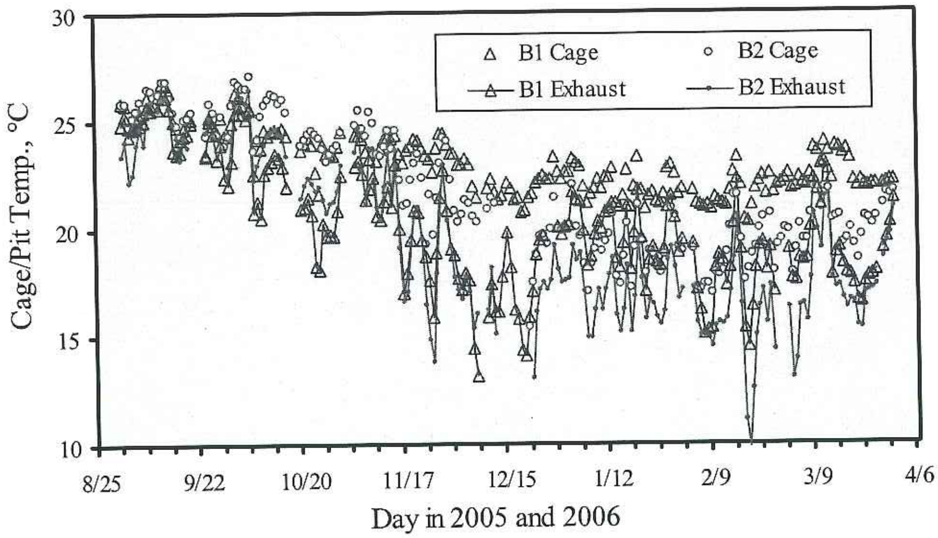

Figure 6. Daily mean cage and pit exhaust temperatures

The ADM fan differential pressures (averages of the west and east sidewall sensors) were -24.7 and -11.9 Pa for B1 and B2, respectively (Figure 7). The daily mean fan pressures ranged from -5.4 to -32.6 Pa, and -2.5 to -16.8 Pa for B1 and B2 respectively. It is not known why did the two barns had such difference in the fan differential pressure, even though they had similar barn temperatures and ventilation rates. The inconsistent B1 pressures in the months of September and October 2005 indicated pressure was not well maintained, suggested that the ventilation inlet openings were not controlled according to barn static pressure to provide optimum ventilation fan operation.

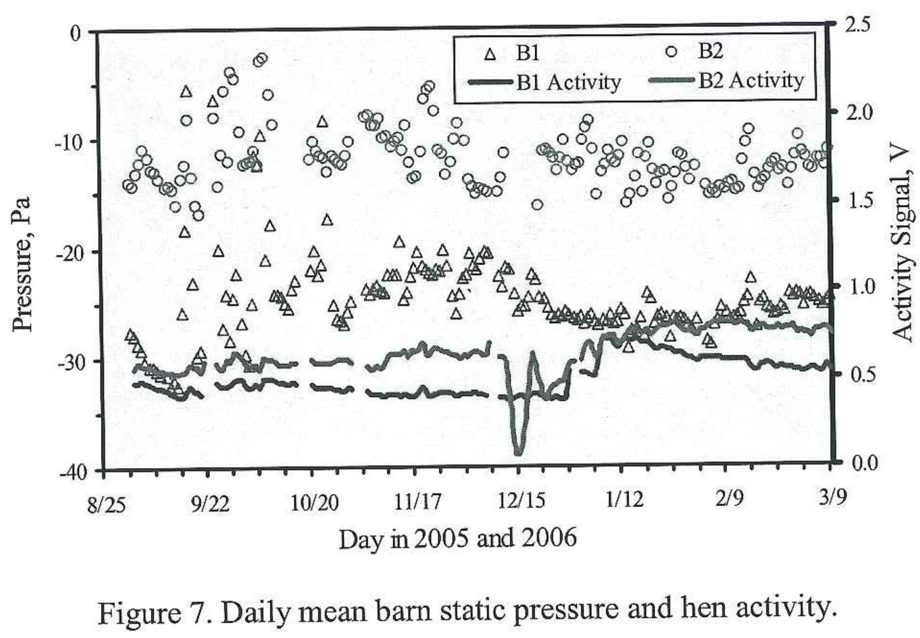

Figure 7. Daily mean barn static pressure and hen activity.

The ADM hen activity of B1 was 0.50 mV, and was 0.64 mV for B2 (Figure 7). The mean B2 activity signal declined to about zero in mid-December 2005 because the spent hens were being removed. The B2 activity increased gradually after the barn was stocked full and the light schedule was lengthened. The barn lighted hours were usually kept shorter for the younger hens. The small peak of activity around December 20, 2005 was due to an extended period of the lighted schedule in B2. The lights of B2 were accidentally kept on for December 20 and 21; thus the higher hen activity signals were detected. The hen activity of B1 was generally lower than B2. However, since the performance of activity sensor was affected by factors such as light intensity, detection angle, and cleanliness of the sensor cover, and because the sensors could not be calibrated for uniform performance, the signals were used only for relevant comparisons within each barn.

Daily mean exhaust air relative humidity (RH) ranged from 47% to 83%, and 42% to 72% for B1 and B2, respectively, while the ambient RH ranged from 44% to 96% (Figure 8). The ADM RH was 76% for ambient air, and 67% and 57% for B1 and B2, respectively. The exhaust RH of B2 appeared to be consistently lower than that of B1. The ADM cage RH of B1 was 53%, and was 54% for B2.

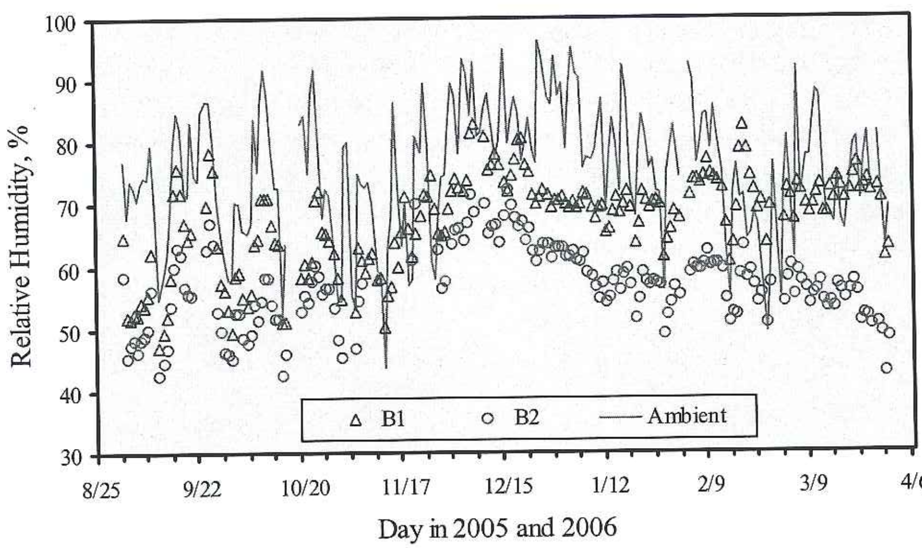

Figure 8. Daily mean barn exhaust and ambient RH.

Results of PM_{10} Measurement

Ambient PM_{10} concentration was 73.8 $\mu g/dsm^3$ (n= 170 d), and ranged from 13.2 to 188 $\mu g/dsm^3$ (Figure 9). The ambient PM_{10} concentration was generally higher in warm weather and lower in cold weather. This is most probably due to the high volume of barn exhaust air, though the barn exhaust PM_{10} concentration was lower on the warm days. The other reason was probably due to the sampling location of the ambient TEOM monitor, which was located in between two barns.

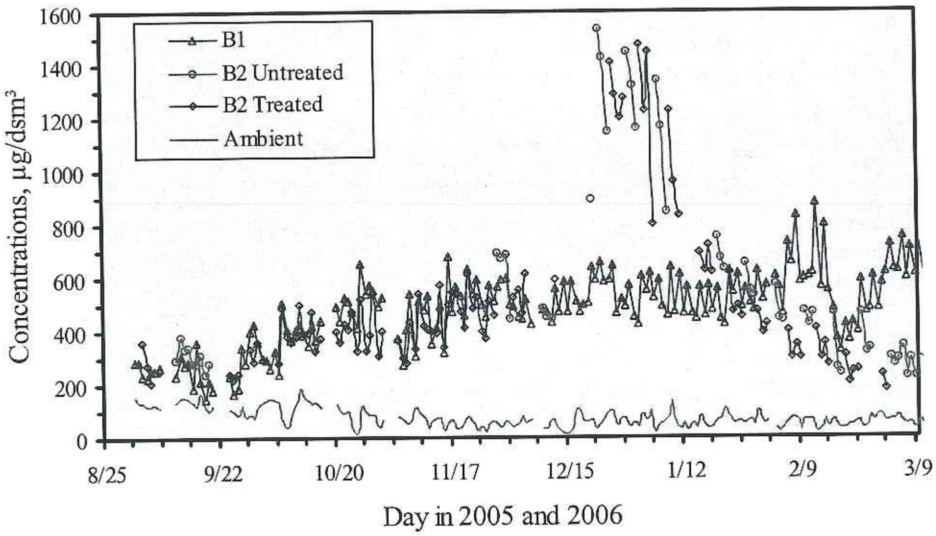

Figure 9. Daily mean PM_{10} concentrations of ambient, B1 exhaust, and treated and untreated B2 exhausts.

Based on paired comparison, the ambient PM_{10} concentration averaged 18.8% of the untreated B1 exhaust concentration. The differences between ambient and B2 exhaust concentration ranged from 3% to 60%, and were generally lower in the warmer days and increased into the winter. This finding agrees with the claims earlier (Lim et al., 2005) that the ambient PM_{10} contributed a significant part of the gross emission, and the ambient concentrations were higher in the warm weather than the cold weather. By having an ambient TEOM monitor for the entire monitoring test, the measurement was greatly improved from the previous Silsoe test, because the net barn emission rates could then be calculated.

The ADM PM_{10} concentration in the B1 exhaust air was 475 $\mu g/dsm^3$ (n=170, or 92% completeness). In B2, the ADM treated PM_{10} concentration was 494 $\mu g/dsm^3$ (n=99 d), whereas the ESCS treated ADM was 613 $\mu g/dsm^3$ (n=46 d). However, the differences between the two barns, or between the treated and untreated differences of B2, cannot be directly attributed to the PM removal of ESCS. Firstly, there were only a few untreated days in the Test 2, and the ESCS was not switched off during weekends after November 28, for the within-B2 treated vs. untreated comparison. Moreover, the ESCS efficacy should be evaluated based on emission rate, because concentration could be affected by ventilation rate. More periodic B2/B1 emission comparisons and reductions of the individual tests are provided later in this report.

The new hens produced higher PM_{10} concentrations and emissions when first moved into B2. The higher-than-normal concentrations and emissions lasted for about five weeks (Figures 9 and 10). This supports the reported higher B2 PM_{10} concentrations from new hens in the previous test (Lim et al., 2005). In this test, the new birds in B2 produced higher PM_{10} concentrations and emissions in December 2005 and January 2006. Both treated and untreated PM_{10} concentrations of B2 were greater than B1 until the end of January 2006, which approximately corresponds to the six weeks of adaptation.

The daily mean ESCS voltages are given in Figure 10. The operating voltage of the ESCS was increased after September 26, 2005. The ESCS power supply unit failure caused the mean ESCS voltage to be lower in December 2005. The ESCS voltage seemed to have a decreasing trend in the second half of the test, even when all of the ESCS lines were repaired after January 15, 2006.

The daily mean PM_{10} emission rates ranged from 1.15 to 11.9 g d^{-1} AU^{-1} for B1, and ranged from 1.29 to 17.2 g d^{-1} AU^{-1} for B2 (including treated and untreated data). The ADM untreated PM_{10} emission rates of B1 was 5.03 g $d^{-1}AU^{-1}$ (14.1 mg d^{-1} hen^{-1}). These values were lower than a typical short-term summertime gross emission of 16±3.4 g d^{-1} AU^{-1} for a high-rise layer barn (Lim et al., 2003). In the previous test with the same barns, the ADM untreated PM_{10} gross emission rates of B1 and B2 were 9.2 and 12.6 g d^{-1} AU^{-1}, respectively (Lim et al., 2005); the higher values were most probably due to the higher ventilation rate applied during the warmer weather. No net emission rate was reported for the two barns in the previous test; however, the emission values would be comparable if considering the 18% ambient concentrations measured in this study.

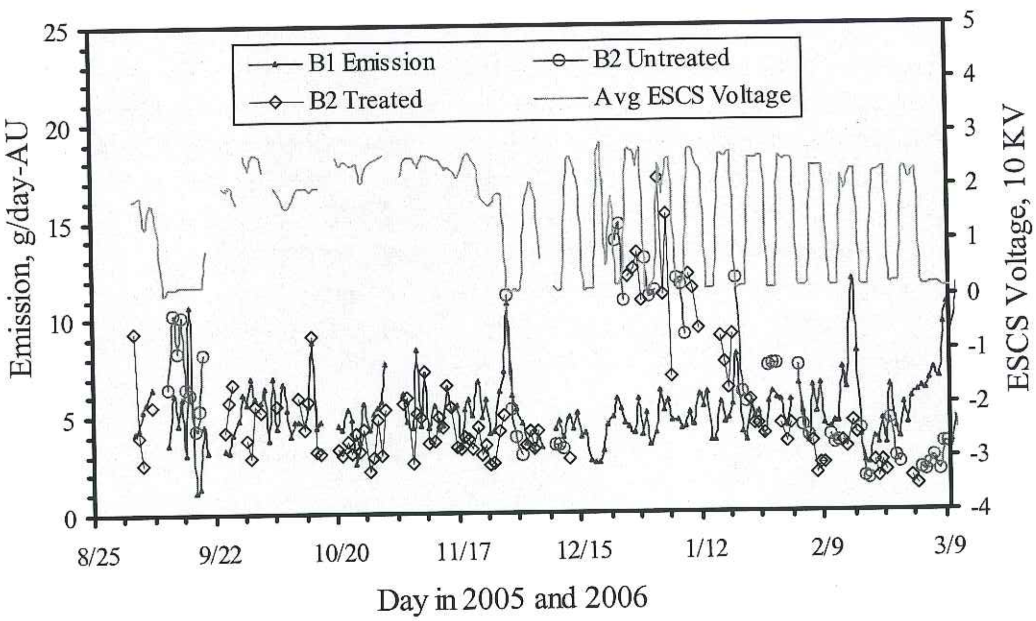

Figure 10. Daily mean PM_{10} emission rates of B1 and B2.

Based on paired B1 and B2 emission rate comparison, the overall (all tests combined) untreated and treated PM_{10} emission rate of B2 averaged 50% and 3% higher than B1, respectively, suggesting an overall 47% reduction. However, the reduction of PM_{10} emission rates was 23% based on measurements with (treated) and without (untreated) the ESCS within B2 for all the tests. The reduction of PM_{10} emission rates was only 12% based on measurements with (treated) and without (untreated) the ESCS within B2, after November 28, 2005 when the ESCS lines were switched off on weekends. However, the reduction was probably hindered by the new flock of hens in B2, because the individual

Test 7 results were as high as 36%. It is thus essential to evaluate the emission rate reduction for each test based on these considerations:

1. There were more treated B2 emission data than untreated data and the treatment schedule was not uniform.
2. There were ESCS power unit failure incidents.
3. Higher-than-normal PM generated by a new flock of hens in B2.

Average daily mean PM_{10} emission rates were 4.4 and 7.3 g d^{-1} AU^{-1} for B1 and B2 during the Alum spraying period of Test 2 (Table 4). Using the mean paired B2/B1 emission comparison of Test 2 as baseline data, the ESCS reduced the PM_{10} emission by 37% and 61% in the Tests 3 and 4, respectively. However, the reduction in Test 4 could be biased by the lack of untreated B2 emission data, and the fact that the September 2005 Test 2 baseline data was only 10 days, and may not be comparable to the October and November 2005 emission rates in Test 4.

Table 4. Summary of ESCS test results for PM_{10}.

Test	Concentration, μg/dsm³				Emission, g d^{-1} AU^{-1}				
	B1	B2 Ctrl.	B2 Trt.	Diff.	B1	B2 Ctrl.	B2 Trt.	Diff.	Reduction
1	259	n/a	272	-4.7%	5.2	n/a	5.3	-2.5%	*48%
2	240	305	n/a	-27%	4.4	7.3	n/a	-65%	baseline
3	267	n/a	260	2.8%	4.5	n/a	5.1	-12%	*37%
4	443	n/a	409	7.7%	5.3	n/a	4.4	18%	*61%
5	511	555	501	2.0%	5.0	4.8	3.5	30%	†5%
6	536	1265	1053	-96%	4.9	12.0	11.0	-124%	†16%
7	560	464	355	37%	5.3	4.7	3.3	38%	†36%

* Reduction was calculated by comparing the paired B1 and B2 emission rates with the Test 2 values.

† Reduction was calculated by comparing the paired treated and untreated emission rates within the test period of B2.

Higher reductions were achieved at certain test periods (48% for the beginning of test, and 36% at the end of test after the new hens had adapted to new environment). Furthermore, the treated daily mean PM_{10} concentration and emission rate of B2 was generally lower than untreated B1 throughout the test (Figures 9 and 10), except when the new flock of hens were moved into B2. The lowest reduction was detected for Test 5, which was probably due to the large amount of PM generated by the new hens.

There was no significant difference (analysis of variance test) between B2 treated and untreated emission rates for the period of November 28, 2005 to March 4, 2006 (partial Test 5, and Tests 6 and 7), which was when the ESCS was switched off periodically for untreated emission measurement (Figure 10). However, the treated emissions were consistently lower after the new hen adaptation period; the reduction averaged 36% in Test 7. The PM removal efficiency of ESCS could have been reduced or affected by the declining ESCS voltages of Line 1 in the last test (Figure 11). The mean voltage of ESCS Line 1 was 19.6 KV in Test 7, while it was 23.8 KV in Test 6. The lower ESCS voltage of Line 1 could have had a more significant effect in reducing the PM removal performance, because this line was located nearest to the South side PM monitors. The voltages of the other three ESCS lines were higher than 23 KV in the last two tests.

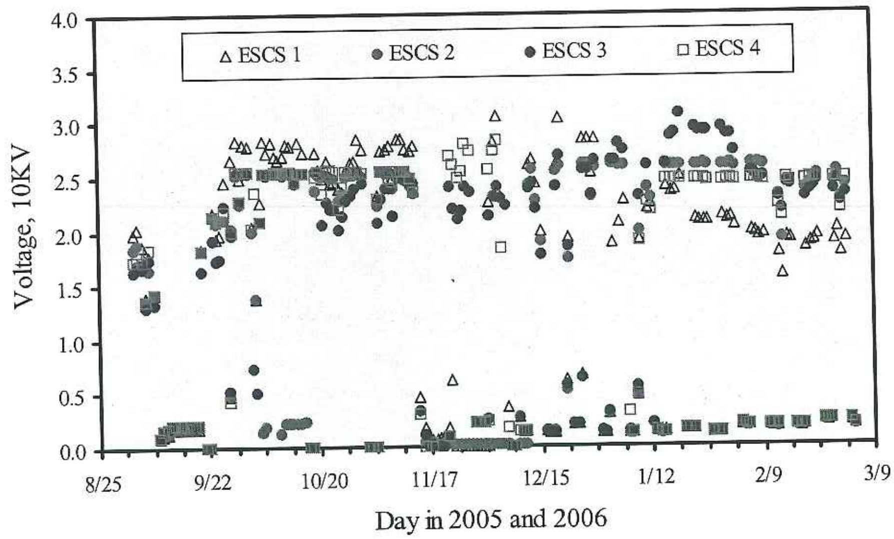

Figure 11. Daily mean TSP concentration and emission rates.

The ESCS performance appeared to be affected by the voltage in the earlier tests. After the ESCS voltage was increased on September 26, the PM reduction was also increased. The emission rate of B1 was 12% lower than B2 in Test 3, but was 18% higher in Test 4. The PM removal efficiency of the ESCS was also hindered by the power unit performance and failure, and by the introduction of a new flock of hens into Barn 2. The overall ESCS performance was expected to be higher if there was no power unit failure, and no flock change in B2.

Results of TSP Measurement

Mean TSP concentration in the exhaust air from 51 measurements at B1 was 3129±599 $\mu g/dsm^3$. The mean untreated TSP concentration of B2 was 2067±708 $\mu g/dsm^3$ (n=9), and the mean treated TSP concentration of B2 was 2186 $\mu g/dsm^3$ (n=38). The overall mean treated TSP concentration of B2 was slightly higher than the untreated concentration, which was probably due to the small number of sample, and the fact that the B2 TSP concentration had a decreasing trend, especially with the new flock of hens (Figure 12). The TSP concentration of B1 was comparable to the values reported last year from the same barn (Lim et al., 2006).

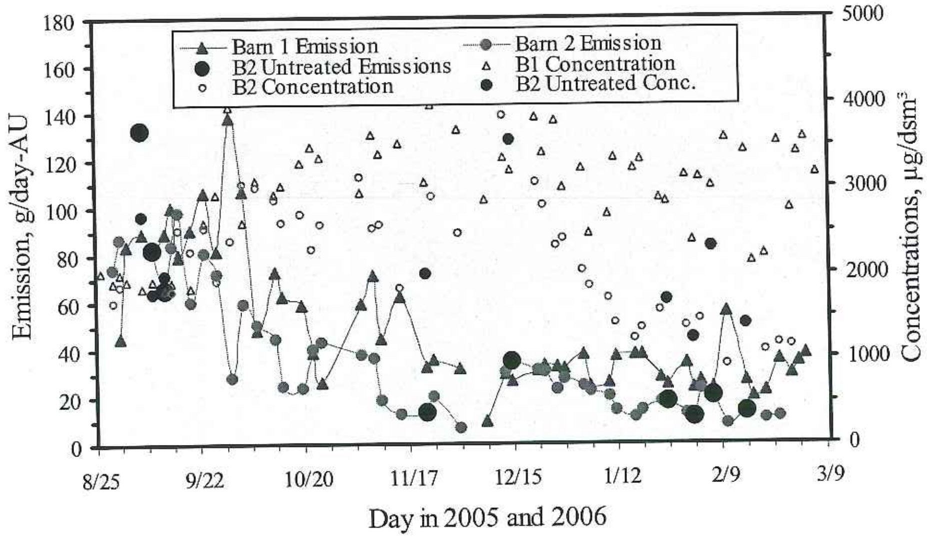

Figure 12. Daily mean TSP concentration and emission rates.

The overall mean TSP gross emissions were 252, 191, and 238 mg/s (49.1, 43.5, and 35.1 g d^{-1} hen^{-1}) for B1, and B2 treated and untreated, respectively (Tables 2 and 3). The TSP emission rate of B2, treated by the ESCS, was 24% lower than the control B1, while the untreated B2 TSP emission was 6% lower than B1, suggesting an overall reduction of 18% from the ESCS treatment. The ESCS-treated TSP emission rate was 19% lower than the untreated value. However, these differences cannot entirely be attributed to the ESCS removal efficiency, because there were only a few replications of untreated TSP measurement in B2. The other factor was that a decreasing trend of TSP concentration and emission rate was noticed for B2, which is similar to the B2 PM_{10} measurement. Thus, the individual test emission differences and reductions are needed to evaluate the ESCS performance (Table 5).

Table 5. Summary of ESCS test results for TSP.

Test	Concentration, $\mu g/dsm^3$			Emission, g d^{-1} AU^{-1}				
	B1	B2 Ctrl.	B2 Trt.	B1	B2 Ctrl.	B2 Trt.	Diff.	Reduction
1	1989	n/a	1760	86	n/a	80	12%	*12%
2	2128	2051	n/a	88	91	n/a	4%	baseline
3	2888	n/a	2386	94	n/a	79	17%	*22%
4	3397	n/a	2628	63	n/a	45	23%	*33%
5	3615	1992	2402	27	13	13	34%	†2.3%
6	3351	3556	2414	33	35	26	28%	†25%
7	3139	1327	1333	31	12	14	58%	†-12%

* Reduction was calculated by comparing the paired B1 and B2 emission rates with the Test 2 values.

† Reduction was calculated by comparing the paired treated and untreated emission rates within the test period of B2.

Similar to the analyses of PM_{10} emission, the comparison of paired B2 and B1 emission rate in Test 2 (untreated test) was treated as baseline data. In Test 2, the mean gross TSP emission rates were 88 and 91 g d^{-1} hen^{-1} for B1 and B2, respectively, and the difference was 4%. Based on this baseline data, the ESCS reduced the emission by 22% and 33% in Tests 3 and 4. The ESCS performance in Test 5 could be degraded by several power supply unit failures. Since there was only one untreated TSP measurement conducted when the new flock of hens were recently moved into B2, it is not known if the new hens caused the higher TSP concentrations similar to the PM_{10}. In fact, the B2 untreated TSP emission taken on December 23, 2005 was the highest for second half of the test. The B2 TSP concentration and emission for the new hens were comparable to those from B1, although the PM_{10} concentration and emission values of B2 were more than twice of B1 within the test period. This suggests that the new hens only created noticeably higher PM emission for the smaller particulates (PM_{10}).

No reduction was found in the last test when comparing the treated and untreated B2 TSP emission rate, although the treated B2 TSP emission was less than half of B1. The PM removal efficacy of the ESCS could be affected by the lowered Line 1 voltages measured in the last test, as discussed earlier. Unfortunately, there were only four untreated TSP measurements conducted in Test 7. It is not known what caused the B2 TSP concentration and emission to decrease at the second half of the test. Since a similar trend was also found for the PM_{10} data, the possibility of a systematic equipment failure or biasness is very low, especially when the TSP sampling flow rates were measured at the beginning and ending of each sampling event. Although there was no significant TSP reduction found based on the ESCS treatment in B2, the continuous and more frequent PM_{10} measurement data suggest that the ESCS was capable of reducing PM_{10} emission.

Conclusions

1. The average daily mean untreated net emission rates ranged from 1.15 to 11.9 g d^{-1} AU^{-1} for B1 and averaged 5.03 g d^{-1} AU^{-1} (14.1 mg d^{-1} hen^{-1}) for B1.
2. The ESCS reduced PM_{10} emissions by 47% based on overall paired B1 and B2 emission rate comparisons. However, the reduction of PM_{10} emission rates was only 12% based on measurements with (treated) and without (untreated) the ESCS within B2 for the periods when ESCS was switched off on weekends for within-barn comparison. The 12% reduction was probably hindered by ESCS failure and introduction of a new flock of layers into B2. The PM_{10} emission reduction was 36% in Test 7, while the reductions were only 5% (ESCS failure) and 16% (new hens) for the Tests 5 and 6, respectively.
3. The overall mean TSP gross emissions were 252, 191, and 238 mg/s (49.1, 43.5, and 35.1 g d^{-1} hen^{-1}) for B1, and B2 treated and untreated, respectively.
4. The ESCS reduced TSP emissions by 18% based on overall B1 and B2 emission rate comparison. The reduction was 19% based on measurements with (treated) and without (untreated) the ESCS within B2.
5. The overall PM removal efficiency of the ESCS was hindered by equipment failure and performance, and new flock of hens. Higher PM removal efficiency was expected and was found for the individual tests.

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